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REPORT

OF THE

OREGON CONSERVATION COMMISSION

TO THE

Governor

NOVEMBER

1912

Oregon's countless resources require development. To bring this about progressive legislation, extending State aid in the work, is necessary. The duty of the State to its citizens in this vital matter is plain.

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REPORT

OF THE

OREGON CONSERVATION COMMISSION

TO THE

Governor

NOVEMBER

1912

SALEM, OREGON
WILLIS S. DUNIWAY, STATE PRINTER
1912

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LETTER OF TRANSMITTAL.

Portland, Oregon, October, 1912.

To His Excellency, Oswald West, Governor of Oregon:

Sir: In accordance with Section 4 of Chapter 81, Laws of 1909, which provides that "The Commission shall prepare and deliver to the Governor, on or before November 30th of each year, a full report of its work, investigations and expenditures, setting forth the condition of the natural resources of the State, together with such recommendations for legislation as may be deemed advisable, or other means of protecting or promoting the development and use of the same," your Commission respectfully submits the accompanying report and recommends that it be published as provided by law.

Respectfully,

JOSEPH N. TEAL,
Chairman.

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BLUE LAKE NEAR SUMMIT OF CASCADES

Good reservoir sites are rapidly becoming an important factor in the development of our water resources, now that the summer flow on most streams is over-appropriated, and the laws make possible the protection of stored water in transit along natural stream channels to the place of use.

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FOURTH ANNUAL REPORT

OF THE

OREGON CONSERVATION COMMISSION

TO THE

GOVERNOR

FACTS REGARDING OREGON'S RESOURCES.

Oregon has one-fifth of the standing timber in the United States, or 545,800,000,000 board feet. The value of this timber, on the stump, is not less than $680,000,000, and when manufactured it will be worth at least $6,822,500,000.

Oregon stands fourth in the list of lumber producing states.

Oregon's timbered area is approximately 25,000,000 acres.

Already the revenue derived from timber exceeds that from wheat, fruit, vegetables and fish combined.

Oregon streams are capable of supplying water to irrigate fully 4,000,000 acres of land.

Of the above fully 2,000,000 acres can be irrigated at a cost of $30.00 to $60.00 per acre, and this land now worth $10.00 to $30.00 per acre would be worth from $100.00 to $500.00 per acre, as well as supporting from 6 to 10 times its present population.

Deschutes River alone, if the work is carefully planned, will furnish water to irrigate nearly 500,000 acres of land.

Of the total area (686,129 acres) of irrigated land in Oregon, only 3.2 per cent has received water through the U. S. Reclamation Service, 3.6 per cent through the Carey Act, 11.3 per cent through commercial enterprises, and most of the balance has come about through individual or partnership enterprises.

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Oregon streams, now unused, are capable of producing 3,300,000 electrical horsepower. Steam engines would consume 36,000,000 tons of coal annually to produce the amount of power going to waste in Oregon's streams.

The total amount of power used in New York State at the present time does not exceed 1,000,000 horsepower, exclusive of locomotive engines.

$43,863,200 is the estimated cost of works to be constructed under permits issued under the new water code in a little over three and one half years.

961,000 acres will be added to the irrigated area of the State if these works are constructed and 176,000 additional horse-power developed. The payment to the State of $47,600 by the promoters is substantial evidence of good faith.

1068 early rights to water have been completely defined and recorded under the new water code affecting 106,686 acres of irrigated land on fifteen different streams at a cost to the water users of only $11,175, all without a single appeal to the supreme court. Adjudications are well under way on eight additional stream systems, affecting in all 275,000 acres of irrigated land.

During 1910, less than $4,000,000 worth of geological products were produced in Oregon, and during the same year Washington produced about $17,000,000 and California $86,000,000. Over $12,000,000 worth of such products were brought in from other states, three-fourths of which, according to the State Bureau of Mines, could have been produced in Oregon.

Oregon is one of four states which have taken no decided steps to determine the amount of their mineral resources.

Oregon's commercial fishing interests as compared with the other industries of the State, are third in magnitude.

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SYNOPSIS OF RECOMMENDATONS

BY

OREGON CONSERVATION COMMISSION.

FORESTS.

An appropriation by the 27th Legislative Assembly of not less than $100,000 for the succeeding two years, for forest protection and perpetuation.

Changes in the present system of taxation, in order to encourage owners of timber to hold their cut-over lands for a second crop.

The acquisition of a state forest through exchange of school sections within National Forests for a solid block of timber.

Provision for purchase by the State of cut-over and burned-over lands for re-forestation purposes, these lands to be held in perpetuity as a State Forest.

LOGGED-OFF LANDS.

Provision by the State for assisting financially, settlers who wish to improve logged-off lands, in order that these lands may be speedily settled; the State to require return of funds advanced, with interest.

IRRIGATION.

Appropriation by the Legislature of $50,000 for detailed irrigation and water power investigations on specific projects, the State to be reimbursed for the cost of any investigation by those who ultimately construct the project. The withdrawal of water rights should precede investigations by the State, in order to protect its investment.

Submission to the people of a constitutional amendment providing for a bond-issue for irrigation and water power development by the State; the money expended being secured by a lien on the land developed or works constructed, and the work to be carried on in cooperation with the U. S. Reclamation Service.

OREGON WATER CODE.

That the amount of water to be allowed the irrigator be limited to not more than one second-foot for eighty acres.

Provision for additional funds for employment by the Water Board of further clerical assistance, and increase in the salary of the State Engineer to an amount commensurate with the duties and responsibilities of that office.

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WATER POWER.

State construction and control of sufficient power projects to regulate the market and insure cheaper power. With an abundance of cheap power available many new industries will spring up and the water resources of the State will serve to assist in its industrial development.

MINERAL RESOURCES.

That the Governor be empowered to appoint a State Geologist and that $10,000 be appropriated to carry on economic geologic and soil surveys in cooperation with the U. S. Geological Survey and Bureau of Soils.

WATER TRANSPORTATION.

The systematic improvement of water-ways and harbors of Oregon in close co-operation with the Federal Government.

FISH AND GAME.

Greater State aid and an active campaign to secure further Federal aid in maintaining and increasing our supply of commercial fish. Proper provision and adequate laws for protecting game and fish along the lines to be recommended by the State Board of Fish and Game Commissions.

FINANCIAL.

An adequate State appropriation to carry on the work of the Conservation Commission involving provision for collection and dissemination of data regarding the resources of the State.

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INTRODUCTION.

In submitting this report the Commission again calls attention to certain conditions relating to the care and wise use of our natural resources, which should receive the attention of the legislature and the people. Though progress has been made, we feel that Oregon is still far behind the procession in matters of this kind, a fact to be particularly deplored in view of the great resources available for use, and which will be used if proper provisions are made.

One of the principal duties of this Commission, as prescribed by law, is the recommendation of legislation affecting our natural resources. It has been the aim of the Commission to make its recommendations in the light of experience elsewhere, and with a view to practical common sense development which will build up the State and cause every dollar appropriated with this end in view to return tenfold in prosperity.

The development of natural resources and the securing of adequate laws to safeguard their use is not, however, a matter which can be speedily accomplished. Each step as a rule has to be heralded by a campaign of education. The Commission has not, therefore, recommended any comprehensive plan covering all phases of conservation and use of natural resources, but has each year taken up a few of the things appealing to it as being of most immediate importance. Working without funds with which to carry on investigations, it has been impossible to, as fully as seems desirable, disseminate information regarding Oregon's resources, one of the duties imposed by law upon the Commission. Were this work possible it is believed that progress in securing a live interest on the part of people generally, regarding our natural resources, would be far more rapid.

That some body in the State must be engaged in collecting and disseminating data concerning lands, waters, forests, fisheries, minerals, and matters of this kind, seems imperative. These resources are either going to be wisely used or to a large extent squandered. The time has long since passed when people held that a State's activities should not enter the field of promoting the economical use of resources in order that the State get the maximum benefit from these resources.

The Commission in the following pages of this report sets forth some of the things Oregon should do. The need is urgent. The State's duty is entirely clear.

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THE CONSERVATION MOVEMENT.

The movement to regulate the use of natural resources in order that all classes may receive their just share of benefit through the exploitation of these resources, has now reached a practical working stage. This is shown by the creation of numerous state conservation commissions, nearly all of whom are working out the problems confronting them by securing adequate state legislation, with funds for administering the laws enacted as well as co-operating closely with the Federal Government in matter which can best and most economically be so handled. The propaganda stage so necessary at the start is now rapidly being replaced by an era of practical constructive work which will have lasting and increasingly valuable results.

The word "conservation" has in the past been used by many misinformed or purposely misled people to typify all that is theoretical, visionary and impractical in dealing with those matters which conservationists have sought to remedy. The questions taken up by this commission and carried to successful issue such as the securing of an adequate water code, modern forest legislation, topographic mapping in co-operation with the Geological Survey and matters of this kind will appeal to citizens of the state as being not visionary but practical; not theory but actual necessities.

Such work as securing settlement of our logged off lands, water for our arid sections, cheaper power for the industries which we have and for those which would come, were this cheap power available, the study of our mineral resources, the protection of our forests and like matters, are being realized as necessities. What other countries have found necessary we also will find to our benefit. To disregard the experience of other states and countries is foolish in the extreme. To fail of action until our resources are largely dissipated would be short-sightedness, for which, in the light of experience right at home, there would appear to be no justification.

As in the case of many other great movements the Federal Government, through the work of the Forest Service, the Reclamation Service, the Geological Survey, and other branches, has shown the way to a practical working out of our problems. And these Federal bureaus now stand ready to assist the states in work which they are beginning to take up.

Through cooperative agreements it is possible to secure the services of experts in almost any line at an expense far below that of hiring such men engaged in private endeavor.

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That the time will come when every state will have in its service men capable, through experience, to deal with its problems, is entirely probable. Until considerable advance has been made, however, safety lies in taking advantage of the experience of the Federal Government in prosecuting state conservation work.

OREGON ADVANCING.

Each year progress has been shown. Our forests are being better protected, water troubles are more equitably and expeditiously adjusted, we bid fair soon to have a state forest,

IRRIGATION IN UMATILLA COUNTY

and information regarding the power and irrigation possibilities of our streams is being secured.

Oregon has, however, done little to stimulate interest in her mineral deposits, and the arid and logged off lands are not being reclaimed with the rapidity desired or expected. The consideration of these matters is of vital importance, and the way to improve conditions is briefly pointed out in this report.

The conservation movement is rapidly and rightly becoming a state as well as a national one. Oregon can and should take a prominent place in leading the way toward equitable regulation and use of her resources.

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PACIFIC COAST DOUGLAS FIR

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FORESTS.

FOREST FACTS.

Oregon stands fourth in the list of lumber producing states, having advanced from twenty-third place in the last ten years.

The last census shows 34,722 people engaged in manufacturing industries in Oregon, of which 16,833 or 50 per cent are employed by the lumber industry.

Out of a population of 672,765 people in Oregon, 84,000 or one-eighth of the total population is directly dependent upon the lumber industry. No other manufacturing industry in the State employs one-tenth as many men as this one.

Oregon's mills in 1910 cut 2,084,633,000 board feet of lumber; 319,894,000 shingles; and 190,660,000 lath.

The value of the above was $30,200,000 or 32.5 per cent of the total value of manufactured products in the State.

Over $70,000 of outside money is each day brought into Oregon by the lumber industry.

Over 80 per cent of the value of Oregon's timber products is paid out for labor, taxes, rent, etc. The lumber industry pays out for wages a greater proportion of the value of its product than any other industry.

The last census shows that out of 55 manufacturing establishments in Oregon employing over 100 wage earners 33 were engaged in the lumber industry.

Oregon's timber pays a large part of the taxes of the State, in some counties the bulk of them.

Eighty per cent of our outgoing freight is lumber.

Oregon has one-fifth of the standing timber in the United States, or 545,800,000,000 board feet.

The value of this standing timber is not less than $680,000,000 and when manufactured it will bring into the State for circulation at least $6,822,500,000.

Already the revenue derived from Oregon's timber exceeds that from wheat, fruit, vegetables and fish combined, and cutting has hardly begun.

Oregon's timber area is approximately 25,000,000 acres, of which about one-half is publicly and one-half privately owned.

Timber owners spend each year to protect their property against fire from $150,000 to $200,000 and employ about 240 patrolmen. The State expends $30,000 yearly and received, in 1912, $10,000 from the Federal Government for patrol. They employed, in 1912, 88 patrolmen.

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Approximately 4,000,000 acres of Oregon timber, or 160,000,000,000 board feet, has so far been destroyed by fire. This timber if standing would be worth at least $240,000,000.

A few of the states that spend each year large sums for forest work are: Maine, $68,000; Minnesota, $75,000; New York, $149,000; Pennsylvania, $313,250; Washington, $38,000. Oregon, with one-fifth of all the standing timber in the United States, spends only $30,000.

Oregon's forests still constitute, next to land itself, her greatest natural resource. Though ravaged for centuries by destructive fires and insect pests, and though some four million acres, nearly one-sixth of the present forested area of the State, has been denuded through lack of protection, there still remains a wealth of timber far surpassing that of any other State in the Union.

Viewed from any standpoint Oregon's forests are worthy of every protection with which they can be surrounded, and in affording this protection the Government, State and private owners must work harmoniously together.

The past two years have been for Oregon the period of greatest advancement in forest protection, brought about in no small degree through the influence of an excellent forest law passed by the legislature of 1911. This legislature, though making an appropriation which, when compared with those which went before it, might seem liberal, still failed fully to appreciate the absolute necessity for the State's taking a leading hand in forest protection, and did not furnish sufficient funds to secure for the ordinary years the results which the people can reasonably expect.

Oregon is still far below the place she should occupy among timber states in forest protection and management. Other states with not one-fiftieth part of our resources are each year expending from two to ten times more money than we are in safeguarding their forests. Viewed from a strict business standpoint, Oregon could well afford to expend in protection five times the present appropriation for this purpose. During the one year of 1910 forest fires took from the State property which had it been saved would at some time have brought in over $23,000,000 of outside money. In 1911 destruction through fire was reduced to less than one-twentieth of this amount, and 1912, when final figures are available, will show an equally gratifying condition of affairs. This bettering of conditions is not due to chance, it is the result of greater activity on the part of all agencies—Government, State and private.

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It is conservatively figured that had the 4,000,000 acres of timber in Oregon destroyed by fire been available for taxation the past year they would have returned a revenue of not less than $1,400,000. Had this property been protected tax payers of the State would have been better off by the above amount.

When it is considered that destruction of timber results not only in reducing taxable property in the State, but takes away a large field for labor, affects directly our agricultural development, and that of manufacturing industries, it is not difficult to realize the State's responsibility in protecting this the most vulnerable of its natural resources. No conservation question so directly affects the people as this one; none should receive more careful consideration by the Legislature. Wise action will result in doing away with the needless destruction of timber; failure so to act can only result in each year increasing the burden of taxation to be bourne by farm and other property, as well as taking from the State a field for labor, which means less rapid increase in population and a smaller amount of money in circulation.

FOREST LEGISLATION IN OREGON.

In Oregon, as elsewhere, the realization that injury to forest resources and forest industry is a community injury, and that failure to insure against it means loss to every citizen, has been of gradual growth. Oregon's possession of more forest wealth than any other State tended for a time to produce indifference, instead of a logically greater concern because it had more at stake, and in establishing the existing protective system less than two years ago it was the last of the Pacific forest states to give the subject serious attention.

The first legislative recognition was of simple property rights, when in 1864 to set fire to "prairie or other grounds" was included among trespass prohibitions and an injured party was thus given opportunity to prosecute. The same principle underlaid more specific sections added to the criminal code in 1893, providing punishment for both wilful and negligent kindling of fires injuring woodlands or property. There was no other acceptance of responsibility by the State for enforcing these laws. Their violation was not the signal for any official effort to punish the offender for a crime against the community, like murder, robbery, or even arson. Indeed it was impracticable to secure much official aid in prosecution instigated by an injured party. Offenses were regarded as personal property affairs, interesting only those involved, and juries were more apt to sympathize with a defendant than with a complaining property holder.

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A change of view was indicated when in 1899 an act establishing a State game and forestry warden, with deputies, included among their duties the enforcement of statutes for "the protection of forests and timber lands from fire." But although this was significant in reflecting a more modern attitude, and undoubtedly had a restraining effect upon carelessness in some localities, the act was primarily a game law and by emphasis discouraged its executives from any fire work not easily incidental to their more specific duties in localities determined wholly by the requirements of game protection.

In 1903 a measure recognizing the duty of the State to enforce any forest laws on its statute books was passed by the Legislature largely upon the insistence of the timber interests. It provided for a state forest commission of five members from as many districts, for county fire wardens paid by the State, for additional rangers paid by the Counties, and instituted a close season and burning permit system. This bill was vetoed by Governor Chamberlain (who later became an advocate of forest protection) because it involved expense to the tax payer.

In 1905 many features of the bill vetoed two years before were returned to the Legislature in one which abandoned hope of State aid, but authorized county courts to appoint wardens paid by timber owners and required burning during the close season to be done under permits from county clerks. This was passed and became the State's first serious fire law.

During the following two years, considerable opposition to the law grew up, because while it required settlers to get permission for burning to clear land, this was obtainable only at the county seat and was good for so limited a time that much difficulty resulted. When the Legislature of 1907 convened nearly a dozen members were pledged by their constituents to introduce bills repealing the law. This threatened to destroy all forest protection in Oregon. Those most interested in preserving it, the forest owners, could do little on their own initiative for they were regarded as responsible for the objectionable permit section, and consequently shared in the hostility against the measure.

At this juncture one or two representatives of the federal Forest Service, naturally desirous of promoting forest protection, took the opportunity afforded by the agitation, and visiting Salem quietly proposed to some of the interested members the substitution of a measure which would meet all objections to the old one yet contain many new elements of advance. The result was the bill introduced by Senator

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Bingham, and passed with little change, establishing a State Board of Forestry, outlining the State's functions in forest protection, classifying and tightening the punitive sections, and providing for the first time a state-controlled warden force with police authority and power to issue burning permits. This force was appointed by the Board but served voluntarily or under compensation other than by the State. It was still impossible to secure any appropriation further than $250 a year allowed for postal purposes.

This act created a framework of State sanction, enabling such additions for actual work as other agencies would contribute, and progress up to a certain point was rapid. The Board of Forestry was unpaid, but being composed by the act itself of representatives of interested institutions, did not remain inactive. A volunteer secretary did the necessary office work and funds for its correspondence and postage were contributed by the Oregon Conservation Association. With the encouragement of State backing, morally if not financially, timber owners greatly increased their patrol activities. Much was done to arouse public sentiment. Still, such a system was absurdly inadequate and its accomplishment was hardly more than proof of real demand and opportunity for serious work by the State itself.

Attempt to obtain an appropriation by the Legislature of 1909 failed partly because of imperfect organization and partly because of insufficient plans to amend the act so as to convert its voluntary machinery into a systematic branch of government expenditure. But during the following two years general public progress in forest protection was marked in Oregon. The timber owners' patrol associations of the other northwestern states organized the league known as the Western Forestry & Conservation Association which became a powerful agent in moulding sentiment throughout the Coast. It brought about organization of Oregon owners in the Oregon Forest Fire Association and continued to act with this organization in stimulating co-operative patrol in the State. The Oregon Conservation Association continued to devote most of its energy to the subject and the State Conservation Commission, previously engaged more actively in water questions, centered upon it.

By the close of 1910, a bad fire year in which the federal Forest Service and the Association demonstrated the profit of organized expenditure, the friends of forest protection were united to work harmoniously and effectively and there was also more general interest than ever before. Oregon had not

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shown to advantage by being the only state in the Pacific Northwest to meet such a season with no facilities except the militia to protect the lives and property of its citizens. Loss of both was heavy. A complete and modern forest bill prepared jointly by the State Conservation Commission and the Western Forestry & Conservation Association and endorsed by all similar agencies, was introduced in the 1911 legislature by Representative Buchanan, and, after a brief skirmish with the old-time opposition, received overwhelming public support and was passed almost unanimously.

THE PRESENT LAW.

The forest law, now in operation, is based upon the principle of encouraging every element to bear a share of the protection burden. It stimulates private effort and provides for relieving the State, so far as is found wise, from such responsibility and expense as can be secured through the interest and practical efficiency of timber owners. At the same time it retains sufficient state control and permits the State to act where private effort cannot be depended upon. It encourages county and federal, as well as private, participation. It has been notably successful in thus securing expenditure by others than the State, and in bringing all agencies into a co-operation which minimizes frictional or duplicate effort. It is the only western forest law which keeps the appointment and direction of the State Forester wholly out of politics.

The salient features of the law are (*a*) a Board of Forestry consisting of the Governor, the head of the state forest school, and five representatives of the agencies most competent and interested, like the federal forest service, the state grange, and the lumbermen's and timber owners' associations; (*b*) provision for both state-paid and voluntary fire wardens; (*c*) encouragement of co-operative private or county patrol work under organizations and districts approved by the State; (*d*) provision for financial co-operation with such patrols by the State Forester, when this is to public advantage; (*e*) comprehensive punitive sections, strictly regulating the use of fire and the disposal of inflammable material, yet flexible enough to permit suitable application to varying conditions.

Two years of operation have developed no weaknesses of consequence, proposals of amendment being very few and confined wholly to minor technical points of the punitive principles. It would be extremely unwise to amend the present law except to make certain changes in reference, necessary because of mistakes made in committee when the first draft

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of the bill was slightly rearranged. The chief point of concern in the present bill is the adequacy of appropriations to maintain a sufficient warden force. While the present appropriation of $30,000 a year may serve in unusually favorable seasons, such as that of 1912, when eked out with funds contributed by the federal government under the Weeks Law, it is manifestly a pitifully small insurance of the tremendous community values in life and resources that are hazarded by every bad year. It has been adequately shown that the State Board will exercise care in the expenditure of funds intrusted to it. Fire protection, the most important matter for immediate consideration, is a matter for which the expenditure cannot be accurately foretold each year. An appropriation to meet at least the ordinary year should therefore be made and if conditions prove favorable and expenses correspondingly low unexpended money can be returned to the treasury. If funds are insufficient on the other hand a vast amount of property and even human life may be sacrificed for want of a few thousand dollars.

In approaching recommendations for further forest legislation, it may be well to outline the objects to be sought. To disregard details and confine the list to fewest possible inclusive essentials of a comprehensive state forest policy, these may be stated about as follows: Adequate fire protection, application of forestry priciples to cut-over land, acquisition by the State of lands fit only for growing timber, scientific taxation of timber lands; facilities for educational work along the lines of forest economics.

We have seen that, except in appropriation, Oregon has the first of these things satisfactorily established. The last has also a preliminary framework, for the same law provides for technical and educational work when time and money build up facilities. The other points it has not yet considered, Although less immediately urgent than fire protection, they are equally essential in any far-seeing permanent policy. History elsewhere has shown that it is good policy for the State to own a large proportion of its land which, while capable of growing forest, does not promise a truly prosperous condition of settlement. If all such land is in private ownership, too small a proportion is made to produce wealth to its fullest capacity, or, through enhancing in taxable value, to contribute its due share to the cost of government. Private forestry should be encouraged, but it is deferred by delay in securing necessary conditions. Moreover, it will always be confined to the most promising areas. State action will hasten results, secure them on lands otherwise likely to remain waste, and is

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peculiarly profitable as a public enterprise both because the State has the competitive advantage of freedom from taxation and because it has not the freedom of private enterprise in profiting by highly remunerative business projects which involve corresponding risk. Old countries have proved that forest growing affords the State a large, safe and permanent revenue which, of course, reduces taxation upon all citizens.

EXISTING PROTECTIVE EFFORT.

As has been indicated forest protection in Oregon originates from four sources (1) The Forest Service, which takes entire responsibility for the proper care of the National Forests, comprising about one-half of the timbered area of the State; (2) The State which through its own appropriation of $30,000 yearly and the Federal funds provided under the Weeks Law (in 1912 $10,000) puts on such patrol as funds will permit of; (3) The timber owners who through associations and individually each year expend some $150,000 to $200,000 for patrol, fire fighting, and the building of trails and telephone lines; (4) Counties, who under the law may independently appropriate funds for protection purposes.

The past few years have seen rapid strides in the quantity and quality of protection given to Oregon's private lands. Some eight or ten years ago individual owners began the patrol of their holdings, but by far the bulk of them have not up to within the past three or four years taken any lively interest in protection. The passage of a fire law carrying an appropriation with which to hire men to enforce its provisions, the formation of the Western Forestry & Conservation Association, and of the Oregon Forest Fire Association, have however, been the means of bringing system into the work and securing results accordingly.

There are now actively engaged in protecting Oregon's timber eight county patrol associations, covering ten counties. Six of these organizations have been formed within the year. The State Board of Forestry and the State Forester cooperate with these patrol Associations so far as this is justified and funds will permit.

Though practically all of Oregon's timber is now receiving some protection a considerable amount is not adequately looked after. About one-half of the privately owned land would receive no protection were it not for the funds provided by the owners of the other half. Part of this area is owned by claim holders, but a considerable amount belongs to those who see fit to profit by the progressiveness of their neighbors. How-

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ever, it is an encouragement that each year the number of those who fail to share in the cost of protection grows smaller.

Though accurate figures of cost for 1912 are not at the time of writing this report available the following figures are approximately correct:

The area patrolled by cooperative associations is approximately 6,300,000 acres and the cost per acre varies from ¼c to 3cts. This cost, however, includes a considerable amount of trail and telephone line building. The balance of the area is patrolled by the State and individual private owners, the State assisting in the areas covered by the cooperative patrols. The cost to owners maintaining individual patrols was for 1911 a little over 4cts per acre and will be considerably less for 1912 due to a smaller amount of fire fighting.

During the past summer approximately 330 wardens patrolled the area outside the National forests and were paid as follows by state and counties, including men hired from Weeks Law funds, 88; by timber owners, 242; besides this number 82 men served as voluntary wardens at the request of the State Forester. This is a considerable increase over the number of wardens employed under pay during the summer of 1911, and marks a step forward in forest protection.

The loss of timber in 1911 was the smallest ever recorded in Oregon, though the year was in many ways a trying one. The loss of 1912 will prove small, and but for a few disastrous fires in May, which started before patrolmen were put on, practically no loss would have been sustained.

The opinion that must be reached in reviewing progress made since the last report of this Commission is that the Forest Law has accomplished surprisingly good results. To sum up, it has brought about:

1. More careful observance of the law, and a consequent lessening of destruction of timber.
2. Better public sentiment affecting the forest wealth of the State.
3. Increased protection by private owners.
4. The introduction of system into forest protection, thus increasing efficiency and reducing the fire hazard.
5. Moral, and in some instances, financial support of county officials in ridding the State of destructive fires.

The State appropriation is, however, woefully inadequate. The Legislature of 1911 was asked to appropriate $100,000 for protection purposes, but only $60,000 was allowed to protect the most vulnerable of Oregon's resources. Each legislature appropriates many times the amount asked for forest protection

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to maintain experiment stations, conduct fairs and for other purposes calculated to assist the farmer. There is no criticism of such action on the part of the Legislature. The money serves a good purpose. However, the protection of our timber, next to the building up of agricultural pursuits, should receive the greatest amount of support from the State. Oregon's timber is valued at $680,000,000 on the stump. There is approximately 12½ million acres of timber land in the hands of private owners, public institutions of various kinds and the State. An appropriation of $100,000 for two years would represent a yearly expenditure on the part of the State of less than .000074 cents per dollar of valuation or of 4 mills per acre. Surely the community interest in timber warrants this expense.

The value of timber is constantly increasing; with the opening of the Panama Canal and the consequent extension of markets, will come increased exploitation of timber, which means a field for more labor. Oregon needs people. A resource which will bring them into the State should not be wasted in order to cut down appropriations by a few thousand dollars.

Private owners have shown, and are showing, a disposition to do their part, but they should not be asked to bear the entire burden. The employees of timber owners cannot effectively enforce the law; nor will the private owner, unless necessity demands, patrol the foothill and brush covered lands where so many fires start which during bad seasons destroy thousands of dollars worth of property belonging to settlers. Over and above all this is the duty of the State to encourage and promote the protection of a resource in which every citizen has a stake. Other states with far less warrant for the action are alive to this responsibility and are shouldering it to the best of their ability.

A STATE FOREST.

Oregon still retains title to about 50,000 acres of school land within the boundaries of the National Forests. The areas are scattered and consequently hard to manage in a consistent manner and in a way to return revenue to the State.

Governor West has consistently urged the exchange of these lands for a solid block of Government land so located that it could be economically managed and held permanently as a State Forest. The benefit to all concerned of such an exchange is obvious. It would eliminate from the National Forests scattered holdings which they now have to protect without any

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return, and it would give the State an opportunity to demonstrate what it can do along actual forest lines.

With the office of State Forester already established and provided for and with a protection program being carried out the expense of administration to the State would be light, and in time through the sale of such timber as could safely be cut the forest would be a paying investment to the State. The scattered holdings could probably never be handled in such a way as to bring the maximum returns and the cost of administering them is sure to be excessive.

Legislative action is, however, necessary to carry out this plan. Congressman Hawley in January, 1912, introduced a bill providing for the exchange of the scattered holdings for a solid block of timber land, to be managed as a State Forest. Later Senator Chamberlain introduced a bill similar to that of Mr. Hawley's but specifying "that in fixing the value of State school sections offered in exchange the Secretary of Agriculture shall take into consideration the value of such lands to the State, by reason of their being available and salable for scrip or base for indemnity selection."

So far as known these bills were never released by the Committee on Public Lands, and further and more aggressive action will have to be taken at the next session.

Governor West has also had this matter up for consideration with Chief Forester Graves of the Forest Service, and the State Forester has been requested to select some area of National Forest land for which the State would be willing to exchange its scattered school holdings. This has been done in a tentative way.

It will therefore be seen that preliminary steps are being taken to secure a State Forest. The matter should not be allowed to drag. There is already precedent for the Federal Government allowing such exchange.

REFORESTATION UNDER STATE CONTROL.

In addition to securing by the State under the most advantageous terms possible the exchange above referred to, it is felt that provision should be made for purchase by the State of denuded areas for purposes of re-forestation. The permanence of a great industry depends upon steps being speedily taken to insure a future crop of timber. The state is in a better position to take up this work than any individual. The state is free from burdensome taxation, and not requiring immediate returns on its investment, could at comparatively small cost secure property which at no far distant time would

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yield substantial returns. It would at the same time assist in perpetuating a vital industry and in rendering productive areas which would otherwise lie idle.

This step would be no new departure. Other states have profited by the lesson taught by older countries and have taken up this work, and there is no reason why Oregon should not make a beginning even though it be in a very small way.

TAXATION.

Reform in forest taxation involves constitutional amendment and radical departure from the existing general property tax, all made peculiarly difficult by lack of general public grasp of forest economics from the community standpoint, and by consequent tendency to confuse what is really a public necessity with apparent incidental advantage to forest owners. It is further complicated at present by controversy over other proposed changes in taxation methods. It is axiomatic, proved by the course of every country where forestry is successfully practiced, that, in order to perpetuate forest production to be used and taxed, such production must not be penalized by confiscatory taxation. The course followed in all such countries, and recommended in this by every student of forest economics, is the most moderate taxation of forest land itself that is consistent with justice, with compensating taxation of the crop only when it produces revenue with which to pay.

Since conflicting amendments to the constitution are to be passed upon by the people subsequent to the issuing of this report, it cannot recommend legislative action governed by constitutional restriction. As a general principle, however, this Commission repeats its recommendation of every practical attempt to bring about ultimately the taxation of all forest crops upon their yield, instead of annually as part of the realty, and its belief that this end will be soonest accomplished by first applying such methods where they are most urgently needed—to the regrowth on burned and cut-over lands which otherwise will remain non-productive and unavailable for either use or taxation.

THE STATE'S DUTY.

It has been the aim of this report to state briefly some of our needs as affecting the forests, and to point out the way in which these forests do and will influence the up-building of the State. Too often in dealing with matters of this kind we are influenced and blinded by the apparent advantage to some class or classes of people. Until the law makers and the citizens

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fully grasp the community interest of our timber resources advancement will be slow. The danger lies in not grasping this until too late. The student of forest economics looking at the forests of Oregon from the view point of their effect upon agricultural development, the use of water for power purposes, as a field for labor affecting all classes, whether the professional or business man or the daily wage earner, and as a source of tax revenue, cannot understand why any state fails to exercise the most careful supervision over this natural resource. The fact that we have a wealth of timber has, however, blinded the ordinary citizen to its importance. A condition where timber, even fire wood, is scarce and has to be used sparingly cannot be realized by people living in Oregon, and yet such a state of affairs has come about in sections once heavily timbered and can come about here through failure to be forewarned.

It is not the desire of this Commission to recommend that any land which can be successfully tilled be kept in forest. A considerable area at present covered with timber will some day furnish farms for a growing population. But probably at least 80 per cent of the timbered part of the State can never be successfully used for agriculture. To find a use to which this vast area can be put and return revenue to the owners and taxes to the State is in itself an enormous problem. So far as can be seen its greatest use must be to again bear a forest crop. To see that this happens is certainly the duty of the State. It must not be left to chance, its performance must be assured.

The duty of the State must therefore be to encourage forest protection and perpetuation. The essentials to this are:

1. Adequate appropriation of not less than $100,000 the next two years for forest protection.
2. Such changes in the present system of taxation as will tend to encourage the private owner to hold his cutover land for reforestation purposes, and not prematurely strip his present holdings.
3. The acquisition of a State Forest through exchange of school sections within the National Forests for a solid block of timber.
4. Provision for the purchase of cut-over and burned-over land by the State and provision for the re-forestation of these lands which should be held by the State as a future supply of timber.

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LOGGED OFF LAND.

The question of subduing such of our logged off land as can be profitably put under cultivation is one receiving each year an increasing amount of attention.

A few years ago the use of such land for grazing purposes was advocated, and as land prices have increased the actual clearing of the land for the raising of field crops has been sparingly taken up.

In the State of Washington, the Southwest Washington Development Association has established a settler's agency, through which owners of logged off land can dispose of their property, under terms favorable to the settler. The movement was started primarily to secure for the State a larger agricultural population and put to useful purpose land which under ordinary circumstances would lie for a long period in a state of non-productiveness.

A periodical devoted to the question of logged off lands is now published in Seattle.

The State Geological Survey of Washington, in cooperation with the Bureau of Soils of the United States Department of Agriculture, has undertaken soil surveys of the logged off lands of Western Washington, beginning with the Puget Sound region. Two reports based on these investigations have already been issued and contain data that should prove invaluable in advancing the reclamation of this class of land.

Here in Oregon the logged off land question has received far less attention than in Washington. Attempts have been made to form an organization for the settling and disposal of logged off lands, and individual companies have offered reasonable terms of purchase to settlers, but lacking the vast area of stump land which our sister state, Washington, possesses, the movement has received no such support as in that state.

The question is, however, each year becoming more important in Oregon, and is one which should be faced and solved along right lines, if these lands are to prove a factor in the agricultural upbuilding of the State.

It is not a local question confined to the Columbia River or Willamette basin, but confronts, or soon will, every timbered county East or West of the Cascade Mountains. Just as it is necessary to so modify our tax and other laws as to allow of holding, after exploitation, the natural forest lands for succeeding crops of timber, so it is the part of wisdom to assist

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the farmer and home seeker in the clearing of those lands, which will, once this work is performed, add to the wealth of the State and help support her institutions.

Along lines looking to the settlement of land, therefore, two principal problems confront Oregon; the irrigation and reclamation of arid lands, and the clearing of logged off or burned over land. Each is of great importance. The former will be discussed under "Irrigation" in this report. The latter we wish to mention briefly as a matter which will soon have to be seriously considered.

COST OF CLEARING HIGH.

The cost of clearing stump land, particularly in coast counties, has generally prevented the small man from undertaking it. In a few cases companies in a position to use machinery in the work have taken it up. The Federal Government, realizing the problem to be important, several years ago put in the field men to study new means for cheapening the removal of stumps. The result was a decided interest in "charpitting" as a means of stump removal. This process has proven of great value since it allows of clearing by a very small crew. Probably, however, by far the bulk of land clearing, on a small scale, is by use of dynamite and stump pullers. Larger companies use donkey engines, and at least one company a blow pipe process.

The cost of clearing land varies greatly. In the Cascades and in Coast counties, it will seldom fall below $50 per acre and may go as high as $200. In Eastern Oregon the work can often be done as low as $10 to $25 per acre.

When land so cleared has a sale value as fruit land at high price the cost is not prohibitive, but for the raising of ordinary crops the cost price plus clearing price often makes the investment seem a doubtful one. Again the purchaser of a piece of logged off land, even though he can figure out a profit from farming the property after going to the expense of clearing the land, is not in a position to clear for want of funds. Most loggers are anxious to have their cut over lands put in cultivation, they are ready to sell the land at a reasonable figure and give liberal terms.

The Federal Government through the reclamation act and the states through the Carey Act are able to help settlers by putting water on their land and allowing them to pay for it over a term of years. It would seem that provision should be made for assisting the prospective land clearer by advancing him funds which should be paid back with interest, the land

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being the State's security for the loan. This is already being done in some form in many European countries.

The details of a plan such as suggested would require careful working out to insure safety for the State in its investment. We feel certain, however, that this is perfectly possible and we believe further that in the absence of State assistance our cut over lands will either be settled very slowly or else the clearing of them will be undertaken by large companies who in turn will derive their profit by a high charge to the home seeker.

The essentials in a plan of State aid can be summed up as follows:

1. Careful inspection by a competent State officer of any land to be cleared with State funds, and should tract prove of inferior agricultural value money should not be advanced. In other words the State should look on the matter as would any private party contemplating the making of a loan.
2. Conservative regulations governing the sum to be advanced, based either on acreage controlled or total value of property.
3. A system of inspection of work performed to guarantee funds advanced being used on property for purpose of clearing only.
4. Equitable stipulations as to payment of both interest and capital, and strict enforcement of such stipulations.
5. Careful check by the State on management of land and improvements in addition to those made with State funds, such improvements to be required as an evidence of good faith.
6. Provision for the State's taking over property without incurring expense upon failure of owner to fulfill every part of agreement and provision for re-disposal of property.

It is assumed that the applicant for State aid will in each case own the property in question outright, that he will not possess over 160 acres of land or have in his name property other that the land which would put him in a position to secure aid from sources other than the State. The aim should be to help the truly deserving home seeker in substantially the same way he would be helped by the Reclamation Service. It is felt that the end fully justifies the means.

Legislation of this nature is not recommended to the 1913 Legislature. It is not felt that the matter has been sufficiently thought out to justify action at present. It is, however, suggested that the problem be considered for future action.

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LOWER CANYON OF ROGUE RIVER

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WATER RESOURCES.

Irrigation.

Oregon is divided broadly by the Cascade Range into two portions, having widely different characteristics. The western portion is well watered, as it receives a heavy rainfall which furnishes a large runoff to the streams. In the eastern part of the State, on the other hand, there is as a rule a deficiency of moisture.

EASTERN OREGON.

The average precipitation in Eastern Oregon ranges from 8 to 15 or 20 inches and there are only three general localities where there is a large excess of water which in all probability cannot be eventually stored, diverted and used for irrigations. These are lower Deschutes River, lower Klamath River and the streams entering the lower portion of Grande Ronde River from the Wallowa and Blue Mountains. All of these streams receive their waters at too low a level to permit their diversion onto agricultural lands.

In practically all the rest of Eastern Oregon there is more land that can be covered with canal lines than there is water to irrigate it. In Eastern Oregon there are a large number of storage reservoirs, practically every drainage basin including one or more, and in only a few instances will they be of insufficient size to control the entire runoff.

WESTERN OREGON.

West of the mountains, as has been stated there is a heavy runoff, but as a rule it is not distributed throughout the year in a manner to be of the highest utility for irrigation. The streams are all subject to enormous floods in the winter season, from November to March, while the low water period coincides with that of maximum demand of growing crops for moisture.

Storage reservoir sites are limited in number and capacity and for the most part lie too near the heads of the stream courses to be of the greatest value. The amount of water that can be diverted from the tributaries of Willamette River for instance, is limited to the natural runoff during about four months in the summer, and the storage capacity of some six or eight reservoirs.

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TOTAL WATER SUPPLY.

Records of river discharge have now been obtained by the United States Geological Survey, in cooperation with the State, for a long enough time to enable a fairly intelligent estimate of the probable future irrigation development of the State to be made. Such an estimate is presented in the following tables and discussion. It must be borne in mind that the statements of the probable use of water, are in many instances, for the rather distant future, and perhaps not over half of the possible irrigation developments will come within the next 20 years.

Detail surveys of the irrigable valleys of the state have been made in but a few instances and it is therefore impossible

IRRIGATION FROM POWDER RIVER

more than to approximate the irrigable area. A considerable number of reservoirs have been surveyed, and others have been examined carefully enough to show whether or not they are feasible. In many cases the reservoir site could be developed to a much larger capacity than the average runoff of the drainage area.

A brief summary will be presented of the storage and irrigation possibilities of the most important streams of the State. It shows that there is available from the streams of Oregon a water supply sufficient to irrigate over 4,000,000 acres of land.

An estimate of the total runoff of streams and of the portion susceptible of diversion for irrigation; substantially an inventory of water available for irrigation, together with certain facts in regard to the records are presented in the following table:

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TOTAL WATER SUPPLY AND AMOUNT AVAILABLE FOR IRRIGATION.

EASTERN OREGON

Stream and locality	Length of record	Mean yearly runoff (acre-feet)	Capable of utilization (acre-feet)
Tributaries of Columbia River:			
Owyhee River	1904-1912	1,100,000	600,000
Malheur River and Willow Creek	1904-6, 1909-10	550,000	440,000
Burnt River	Estimated	140,000	50,000
Powder River	1904-1911	440,000	350,000
Grand Ronde River above Wallowa River	1904-1910	572,000	350,000
Wallowa River	1904-6, 1909-10	780,000	200,000
Walla Walla River	Estimated	200,000	50,000
Umatilla River	1904-1912	550,000	350,000
John Day River	1905-1912	1,450,000	900,000
Deschutes River at Benham Falls	1905-1911	1,220,000	1,100,000
Crooked River	1909-1911	310,000	250,000
Tumalo Creek	1906-1911	97,000	80,000
Squaw Creek	1910-1911	72,000	50,000
Hood River	1906 and 1910	946,000	120,000
Other streams	Estimated	200,000	100,000
Total Columbia River drainage		8,627,000	4,990,000
Streams in California drainage:			
Link River at Klamath Falls	1904-1910	1,780,000	500,000
Lost River at Olene	1905-1910	283,000	250,000
Total in California drainage		2,063,000	750,000
Streams of Interior drainage:			
Goose Lake tributaries	1909-1911	134,000	107,000
Warner Lake tributaries	1910-1911	300,000	240,000
Abert Lake and tributaries	1905-7, 1909-12	180,000	144,000
Ana River	1904-1912	100,000	40,000
Silver Lake tributaries	1905-6, 1909-12	65,000	52,000
Catlow Valley and Alvord Lake tributaries	Estimated	50,000	40,000
Donner und Blitzen River and tributaries	1909-1911	190,000	144,000
Silvies River and Silver Creek	1904-6, 1909-11	212,000	170,000
Total Interior drainage		1,220,000	937,000
Total Eastern Oregon		11,910,000	6,677,000

WESTERN OREGON

Stream and locality	Length of record	Mean yearly run off (acre-feet)	Capable of utilization (acre-feet)
Willamette River and tributaries:			
Clackamas River	1906-1910	2,420,000	50,000
Molalla River	1906-1908	656,000	70,000
Santiam River	1906 & 1910-11	5,000,000	650,000
McKenzie River	1906-1910	3,500,000	800,000
Middle Fork Willamette River	1906-1910	3,000,000	870,000
Coast Fork of Willamette River	1906-1909	1,570,000	80,000
Lucklamute River	1906-1910	746,000	20,000
Yamhill River	Estimated	1,500,000	40,000
Tualatin River	Estimated	1,500,000	80,000
Total Willamette River		19,586,000	2,060,000
Umpqua River and tributaries	1906-1910	5,000,000	50,000
Rogue River and tributaries	1906-1910	3,200,000	250,000
Total Pacific Ocean drainage		8,200,000	300,000
Total Western Oregon		27,786,000	2,360,000
Grand total		39,996,000	9,037,000

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OWYHEE RIVER.

The Owyhee River basin contains a number of reservoir sites, probably the best one on the main river being at Duncan Ferry, near the mouth of Crooked Creek. This site can be developed to almost any capacity required. The water stored can be diverted near the mouth of the river onto a large area of land. There is a reservoir site on Jordan Creek in Idaho, in which it is proposed to store water for use in Oregon. There is not enough land susceptible of irrigation from the Owyhee to use all the average runoff, but probably somewhat more than that for a low year can be used, say 600,000 acre-feet.

DIVERSION DAM FOR IRRIGATION—BAKER COUNTY

MALHEUR RIVER.

The Malheur River basin is particularly well supplied with reservoir sites. No less than ten have been surveyed by the U. S. Reclamation Service and private parties, but only a few of these would be required to conserve the runoff of the river and its tributaries. The availability of the Harper reservoir, probably the best on the river and one of the best in eastern Oregon, will be destroyed by the building of the Oregon Eastern Railway through it; this would be an almost irreparable public misfortune were it not for the fact that other sites exist which can take the place of it. The Warm Springs reservoir site, on Middle Fork above Riverside, is fully as good as the Harper, and could be developed to provide excess capacity to hold over the excess runoff of a high year to a low year. It

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could be operated to render available seventy or eighty per cent of the total runoff. The Beulah reservoir on North Fork will regulate that stream, and the water from both these reservoirs can be used on both sides of the Malheur and along Snake River near the mouth of the former stream.

There are three reservoirs on Bully Creek, any two of which can be developed to a capacity considerably more than is required to regulate its flow. The waters can be used along lower Bully Creek on land higher than the tract under the Malheur project. Willow Creek has an extremely variable runoff, which requires great reservoir capacity to regulate. At least two good sites are available, one of which has been utilized in an existing project. The total runoff of Malheur River and its tributaries is estimated at 550,000 acre-feet, and it is believed that fully 80 per cent of this can be ultimately used, twenty per cent being lost by evaporation and flood runoff which cannot be stored.

BURNT RIVER.

Burnt River, the next stream north of the Malheur, drains an area above its mouth of about one-fifth that of Malheur River.

As a large proportion of its area lies in the high mountains it is safe to assume its runoff as one-fourth that of the Malheur or 140,000 acre-feet. There is a limited area of irrigable valley along the stream, and the flow of some of its headwaters can be diverted into the Malheur River basin. There are a few good storage reservoirs, and it would seem that perhaps one-third of the total runoff or 50,000 acre-feet might eventually be used.

POWDER RIVER.

The Powder River system presents extensive irrigation developments and possibilities. Along its course lie six valleys of notable size; two of these can be used to advantage as storage reservoirs in which water will be conserved for use in irrigating the other four. The tributaries of Powder River from Elkhorn ridge on the west and the Wallowa Mountains on the north are short swift streams from which water can be diverted relatively cheaply and easily, for both power and irrigation without conflict. Limited volumes of storage are available in the headwaters of these streams. Altogether probably 350,000 acre-feet out of the 440,000 acre-feet total runoff of Powder River can eventually be utilized on the land.

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GRANDE RONDE AND WALLOWA RIVERS.

Grande Ronde River and its principal tributary, the Wallowa, rise in the Blue and Wallowa mountains. Wallowa River drains a portion of the highest and ruggedest mountains in Oregon, receiving as high a precipitation as many portions of the Cascades. The fertile Wallowa valley nestling at the foot of the towering mountains is irrigated from the tributaries of the river of the same name. This valley is of only limited extent compared with its abundant water supply and probably not over one-fourth of the Wallowa's total discharge can ever be utilized. The Grande Ronde likewise is a large river, and with storage, the whole Grande Ronde valley of over one hundred thousand acres can doubtless be thoroughly watered. The total average runoff of Grande Ronde River above the Wallowa is 572,000 acre-feet of which it is estimated that 350,000 can be used in irrigation.

WALLA WALLA RIVER.

Walla Walla River flows through one of the oldest and richest irrigated areas in Oregon. The section is that around the towns of Milton and Freewater. This district, justly famous for strawberries and other horticultural products, has been developed more nearly to its full justifiable extent than any of the areas so far considered. There are at least 6000 acres under present canals. Little exact information is at hand as to the total water supply, utilized or otherwise, of this district, but as a rough approximation it has been taken as 200,000 acre-feet, with 50,000 capable of irrigation use.

UMATILLA RIVER.

The Umatilla River district, favored of location, soil and climate, is at a disadvantage on account of the insufficient reservoir capacity existing. A few storage basins, of limited capacity have been developed or planned along the river itself. Other reservoirs are found on tributary streams, into which the waters of the main river can be diverted by feed canals, as is the case of Cold Springs Reservoir of the U. S. Reclamation Service. Spring and winter flood irrigation is also practiced and its further development contemplated. This is particularly successful on the deep volcanic ash soils of the bench lands, which are very retentive of moisture.

As there are no large reservoir sites susceptible of cheap construction, the ultimate utilization of the waters of Umatilla River will probably be a little in excess of the runoff of a low year, say 350,000 acre-feet.

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JOHN DAY RIVER.

John Day River drains the largest area of any stream rising in the Blue Mountains and although its rate of runoff is low, its total water supply will suffice to irrigate a large area.

The proposed John Day project for irrigating lands lying along the south side of Columbia River in Gilliam, Morrow, and Umatilla counties, will involve a very long and expensive canal, but the lands under it become very valuable when irrigated. There are at least three reservoirs any one of which could be developed to control the entire runoff at the site. The waters of the John Day will probably be utilized to the extent of the mean discharge for the three or four lowest successive years, say 1908 to 1911, less the losses by evaporation, or some 900,000 acre-feet, which will suffice to cover the available land.

DESCHUTES RIVER.

Deschutes River, rising in the lava beds which flank the summits of the Cascades and serve as a natural equalizing reservoir, has the most remarkably uniform flow of any stream in the Northwest. It possesses power sites capable of generating nearly one million horse power, and has an average runoff of about 5,000,000 acre-feet, of which nearly one-third can be ultimately utilized for irrigation. The average runoff of Deschutes River at Benham Falls during the past seven years has been 1,220,000 acre-feet. The Benham Falls reservoir, the largest storage basin which has been surveyed in the State of Oregon, can be developed to any capacity that the water supply will warrant, and as this river varies only slightly from year to year practically the entire runoff can be utilized.

Crooked River, the large easterly tributary of the Deschutes, drains an area which, although extensive, partakes only in a limited degree of the character of the Deschutes. Its rate of runoff is small, and varies widely from season to season and from year to year. There is an excellent reservoir dam-site, just below the forks of Crooked River above Post, and there are smaller sites on tributaries of Ochoco Creek, which enters the main river at Prineville. The total average runoff of Crooked River is estimated at 310,000 acre-feet of which probably 250,000 will ultimately be utilized.

Tumalo and Squaw creeks are tributaries of Deschutes River from the west. They drain only limited areas but their sources are in the high divide of the Cascade range, and their runoff is heavy and well maintained. The waters of Tumalo Creek

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can be stored by diverting them into a reservoir basin near Laidlaw, and this diversion has already been planned by an operating company. Squaw Creek is less favorably situated with respect to reservoirs and its winter flow probably never can be conserved, but a very large percentage of it comes at a time when it is most needed. It is estimated that Tumalo Creek has a total average runoff of 97,000 acre-feet of which 80,000 can be ultimately used, while Squaw Creek has an average of 72,000 of which 50,000 may be utilized.

Some irrigation is being practiced from other tributaries of the Deschutes particularly Metolius and White Rivers, and further developments are possible but little is known as to the feasibility or extent of the projects.

HOOD RIVER.

Hood River, having its sources in the glaciers on the north side of Mt. Hood, lies strictly neither in eastern or western Oregon, but has been included with the former. This river has a large runoff which is considerably in excess for any probable future use for irrigation.

Storage facilities are lacking but the natural summer flow of the stream is well maintained. It is estimated that there will be ultimately utilized a quantity equal to the low water discharge of the stream for a period of 5 months or about 120,000 acre-feet.

KLAMATH RIVER BASIN.

The water supply of the Klamath River drainage basin is furnished by Klamath River proper and its tributaries, and also by Lost River, which while not strictly tributary to the Klamath is still considered a part of the same drainage system, since its lower course is connected with the latter by a slough which carries some water at times of flood. Lost River furnishes a total average runoff of 283,000 acre-feet, and land is available for utilizing all of this water for irrigation, except such as will be lost by evaporation; say 250,000 acre-feet.

The water supply of Klamath River is abundant and the amount of it which can ultimately be utilized depends entirely upon the amount of land which can be economically covered with canals. It has been estimated that at least 100,000 acres on the Klamath Indian Reservation, and 40,000 acres within the Great Basin can be irrigated by gravity and pumping from Williamson River and tributaries. A limited area on the west side of the lake can be covered by diversion from other tributaries of upper Klamath Lake originating in the Cascade

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Range. The area irrigable from Link River by diverting at the lower end of Upper Klamath Lake is large but the feasibility of most of this project depends upon the character of the tule lands which compose the bed and borders of lower Klamath and Tule lakes. It is not unlikely that 200,000 acres will be ultimately reclamed, but of this a large part lies in California. The total amount of water that can be utilized from Klamath River in Oregon is probably not far from 500,000 acre-feet.

INTERIOR DRAINAGE BASIN.

A large portion of Southern Oregon lies in the interior drainage, a section without an outlet, and commonly known as "The Great Basin."

None of the waters of streams rising in this area reach the sea, but instead are lost by evaporation from a series of alkaline lakes or sinks. Large areas of land bordering these lakes is irrigable from the streams tributary to them. These irrigation developments fall naturally into about 10 projects, for the most part co-extensive with the hydrographic basins of the lakes. In the case of all but one or two of these, practically all the water will ultimately be stored and diverted to the lands. Storage reservoirs are abundant and well distributed and nearly all the valley areas through which the streams flow contain as much or more fertile land than can be irrigated by the available water supply.

The one important exception is Ana River, a tributary of Summer Lake. The river rises from springs, none of which are more than 40 ft. in elevation above the lake level. It is possible to divert their flow with a dam, or by pumping, to lands lying north and east of the lake. As no storage is possible only the summer flow can be utilized—say 40 per cent of the total, or 40,000 acre-feet.

The amount of water available from all the other streams of the interior drainage has been taken as 80 per cent of the total, an allowance of 20 per cent being made for evaporation from storage reservoirs and for losses due to excess of water in high years, for which storage cannot be economically provided. The total estimated runoff of the streams in this landlocked area is estimated as 1,220,000 acre-feet or equal to that of Deschutes River at Benham Falls, the portion which can be utilized as 937,000 acre-feet.

WILLAMETTE RIVER AND TRIBUTARIES.

The total runoff from the 10,000 square miles drained by the Willamette River is very great but a large portion of the

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discharge comes in winter and early spring when it cannot be used. The amount of water available for irrigation, is in general, measured by the natural discharge for the four months, June to September, augmented by the limited amount of storage available. Practically all the tributaries of Willamette River have been measured at the edge of the valley and their natural flow is well determined. Our information in regard to the reservoir sites is, on the whole, rather meager as the only surveys are those of a few of the best sites made by private individuals or companies, and the amount of water available for storage at these sites is also subject to a good deal of question. An estimate has been made, however, of the total water supply which can be used from each stream for irrigating Willamette valley lands, and while these estimates may be somewhat in error for individual streams the total is probably not far from the truth.

UMPQUA RIVER AND TRIBUTARIES.

Umpqua River drains a large area of heavy precipitation and its total average runoff is estimated at 5,000,000 acre-feet annually. The valley lands along the tributaries of the Umpqua susceptible of irrigation are of limited area, and it is not believed that more than 50,000 acre-feet can ever be used upon them, or only one per cent of the total.

ROGUE RIVER AND TRIBUTARIES.

Rogue River, the southernmost stream west of the Cascades in Oregon, has a heavy rate of flow which is well maintained throughout the year. There are also large areas of valley lands along its course and those of its tributaries. Topographic conditions are such that it is not economically possible to divert any large portion of the total flow. Little Butte Creek, Bear Creek, and Applegate Creek, are the streams from which most of the irrigation diversions will be made, and the summer flow and storage possibilities of these three streams are limited. It is believed that the ultimate utilization of the water of tributaries of Rogue River will not much exceed a quarter of a million acre-feet.

PRESENT IRRIGATION

The best data in regard to the areas now under irrigation in Oregon, the various classes of projects making up these areas and the rate of increase, is found in the compilations of the United States Bureau of the Census for 1899 and 1909.

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A summary of the essential data contained in this report is embodied in the following tables:

SUMMARY OF IRRIGATION DATA FOR OREGON, 1899 AND 1909

	Number of farms irrigated	Total area irrigated, acres	Total cost of irrigation works	Average cost per acre	Average annual cost of operation and maintenance	Percentage irrigated of improved farm land
1899	4,636	388,310	$ 1,843,771 00	$ 4 75	$ 0 22	11.7
1909	6,669	686,129	12,689,044 00	15 28	0 75	16.1
Increase Amount	2,033	297,819	10,845,273 00	10 53	0 53	4.4
Increase Per cent	43.9	76.7	588.2	221.7	240.9	

CLASSIFICATION OF IRRIGATED AREA OF OREGON BY CHARACTER OF ENTERPRISE.

Character of enterprise	Acreage irrigated in 1909	
	Amount	Per cent distribution
All classes	686,129	100.0
U. S. Reclamation Service	22,000	3.2
U. S. Indian Service	429	0.1
Carey Act enterprises	24,750	3.6
Irrigation districts	1,500	0.2
Co-operative enterprises	149,985	21.9
Commercial enterprises	77,387	11.3
Individual and partnership enterprises	410,078	59.8

The most striking fact shown by this table is the relatively unimportant contribution of the larger organized enterprises to the increase in irrigated area. Thus only 7 per cent of the total has been watered through the agency of the U. S. Reclamation Service, the state under the Carey Act, and irrigation districts. A slightly larger portion, 11.3 per cent of the total was watered by commercial projects, while 560,063 acres, or 81.7 per cent of the total development has been accomplished through individual or cooperative enterprises.

The showing of the larger enterprises, especially those under state or government control, is distinctly disappointing. It also seems that the rate of increase as a whole is not as rapid as should be expected considering the vast areas of unimproved lands lying ready for the irrigator.

Of the four million or more acres which can sometime be watered, perhaps one-half have been the subject of engineering investigations. Most of the surveys have been of a preliminary nature, and the results of many have never been made

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public. But it can be stated on fairly good authority that there are, in Oregon, at least two million acres which can be irrigated at a cost which is fully warranted under present day conditions, say from $30 to $60 per acre. This land, now largely in private ownership, is now worth perhaps $5 to $30 per acre; it supports at most one family for each 320 acres. Irrigated and improved the same lands would be worth from $100 to $500 per acre and would support 6 to 10 times the present population. Why have the attempts to make these lands available for intensive agriculture met with such indifferent success?

DRAWBACKS TO LARGE PROJECTS.

Of the various projects which have been undertaken by the State, under the Carey Act, a number have either foundered on financial rocks or at least, have been reorganized, often more than once. These difficulties have generally been due to one or all of four causes:

1. An unduly heavy initial incubus upon the project, for promotion and organization expenses;
2. Lack of complete engineering plans and reliable estimates of cost;
3. Lack of adequate financial backing;
4. Inexperience and mismanagement in handling the enterprise and colonizing the land on the part of both promoters and state officials.

It is not likely that the same mistakes will be made in future work. There are, however, certain inherent difficulties in the way of successful irrigation development on a large scale by private capital. The returns on the original investment are necessarily slow in coming in, possibly two to five years are needed in gathering stream flow and other engineering data, and two or three years more are occupied by construction work before the payments by the settler begin. The land may be settled up slowly, in most large projects this has been the case, and altogether it may be two or three decades before the original investment is repaid. Experience has proven that capitalists are not willing to wait so long a time for returns on their outlay. In a mercantile business the total capital may be turned over perhaps twice in a year, each time with profit. Even in the case of a railway, which is much more nearly analogous to an irrigation project, the net earnings may reasonably be expected to pay dividends almost from

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the first. But in irrigation the returns are delayed for years, and interest, maintenance, and selling charges are magnified. Under these conditions it has been found to be impossible to interest capital and to insure it a reasonable profit, unless the selling price of the land is fixed at a figure at least double the estimated cost of construction.

If the percentage of profit is increased, to encourage capital to invest, the increased cost of land works a hardship on the settler, retards development and tends to defeat the very object which it was desired to attain with the increase. Often as a result of the attempt to keep down the cost of land and still allow profits, the construction has not been carried out in accordance with sound engineering practices, with resulting poor service to the irrigator, hard feeling, disputes, losses and annoyances.

WORK OF THE RECLAMATION SERVICE.

For nearly a full decade, the United States Reclamation Service has been engaged in its work, first of investigating possibilities and later of building irrigation works. The sale from the vast public domain of this state has contributed a heavy quota to the Reclamation fund. The Reclamation officials, after diligent attempts to harmonize conflicting interests of land ownership, water claims, and railroad and storage rights, were able to select only two projects in Oregon for construction.

The valleys of Oregon were in a way, too good to lend themselves readily to irrigation development on a large scale. The land was sufficiently productive to support a small population under dry farming methods, or with flood water irrigation in the spring, and it had been for the most part taken up before the Reclamation Service entered the field, and the settlers being able to make a precarious livelihood under existing conditions, were loth to place a lien on their lands to assure a permanent water supply. In the other western states, there were at the same time vast tracts of arid sage brush land, almost entirely in public ownership which were admirably adapted to the workings of the Reclamation Act and on which successful projects have since been worked out.

THE STATE'S INTEREST IN RECLAMATION.

The State of Oregon is interested in the development of its irrigable lands as a means of increasing its population, its taxable wealth, and the general well being of its citizens. Governments have often undertaken land reclamation projects

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without any thought whatever of direct return. Thus the British colonial government in India has undertaken the building of many protective irrigation works, as they are called, which in years of drought will save the crops from failure and the people from want and starvation.

In Canada the Canadian Pacific Railway is undertaking the reclamation of three million acres of land with no idea of profit, except indirectly through the increase of freight and passenger traffic.

In Australia, not only the private promoter but also the land speculator has been compelled to step aside for the good of the state. Before public funds are invested in an irrigation enterprise, the dry farm lands are purchased at dry farm prices and after being irrigated by the state, are sold to actual settlers at practically cost of land and water.

IRRIGATION BY THE STATE.

It would seem then that since the other agencies have fallen short of the full measure of success in prosecuting irrigation development, the State should actively undertake the work. As in all engineering work, thorough investigation should precede actual construction. The first step to be taken should be those usually taken by the promoter, the making of preliminary and final surveys, studies of water supply, plans and estimates of cost. The public, should in effect, become its own promoter, acting through some suitable public official. The state might protect itself during the period of preliminary work by withdrawing the necessary water from the operation of its water laws.

At least two alternatives present themselves for handling the actual construction. The state might assign its water rights and sell its plans and estimates to such persons or corporations as will carry out the projects at a minimum cost to the water users and in accordance with plans and regulations approved by the state. Such contracting parties would reimburse the state for the cost of the preliminary studies. This proceedure might well be followed in the case of small projects without complicating features.

With the larger and more costly projects, the state may find it advantageous to carry out its own plans. The state, being able to borrow money at a lower rate of interest than a corporation, and working with no idea of direct profit, would be able to furnish water to the farmer cheaper than could a company. The work would be prosecuted solely with the idea of rendering the best service, and building in the most sub-

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stantial manner, and the final results would be more satisfactory than any company would likely achieve.

It is suggested that should the latter plan be undertaken the state cooperate with the United States Reclamation Service in carrying on this work. The Reclamation Service is an engineering organization, under civil service rules, which has proven its ability to make a success of irrigation and power works of great magnitude, under varying conditions and in different sections throughout the west. If this great organization could be enlisted in the work, the people of Oregon might rest assured that the work would be as completely removed from the baneful influence of politics, as is possible under our form of government, the numerous mistakes inevitable to the inception of a new department would be avoided, and that a comprehensive policy or plan of work would be carried out regardless of changes in administration of either state or national affairs.

Cooperation with the federal government would be especially advantageous on those projects where a considerable proportion of the land needed for development is still in the control of the general government. Cooperation between the state and nation in the investigation of natural resources is not new, it has been practiced in nearly every state in the union. Thus in the State of Oregon, during the present year, the sum of $56,000 is being expended jointly by the State and the United States Geological Survey in stream surveys and measurements and the preparation of topographic maps. This cooperative work has now continued for seven years, with every degree of success and mutual satisfaction.

In cooperative irrigation development, if the work is done by the United States, the state authorities would have a measure of control over the work and could assure themselves that the methods of the larger organizations were adapted to local conditions, and that no unreasonable delays occurred. The work would be carried out under the direction of the State's cooperating officer, and the Secretary of the Interior.

FINANCIAL PLANS.

It is difficult, and in fact unnecessary at an early stage of the working out of such a scheme, to suggest a practicable financial plan. The necessary funds could no doubt be raised by a state bond issue. These bonds would become a lien upon the land and the state would run little if any risk of ultimate loss. With the credit of the state behind the securities the loan could be made at a low rate of interest. It

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might be that the U. S. Reclamation Service could issue some of the bonds which have been authorized, or which may be authorized in the future, to secure funds for prosecuting the work.

DESCHUTES RIVER PROJECTS.

As an example of a large project which the state might take up to advantage, the irrigation situation of Deschutes River may be cited. Surveys and investigations now being conducted by the U. S. Geological Survey in cooperation with the State, indicate that the Deschutes River, if its development is rightly planned and carried out, will generate an enormous amount of hydroelectric power and also furnish water for irrigating nearly half a million acres of arid land. Near the head of the stream at Benham Falls, 15 miles south of Bend, is an excellent reservoir site where a dam about 60 feet high will create a reservoir of sufficient capacity to store all the winter flow of the stream and regulate it sufficiently to enable the use of practically all the water for irrigation. This water will be diverted at a number of points lower down the river, the lowest being near Cline Falls from which water can be conducted to large fertile areas around Metolius and Madras known as the Agency Plains.

Between the reservoir and this lower point of diversion the river falls 1300 feet. There are several almost vertical drops in the stream and a number of dams will be built in connection with the irrigation plans. At all these points power can be generated during the irrigating season at a very low cost. An abundant field for the sale of such power can be found in pumping water for irrigation along the Columbia River and at other points, and also for supplementing the power from plants west of the Cascade Mountains, since practically every developed water power in the Willamette River basin finds a yearly deficiency just at the time when the greatest amount of energy could be generated at points on the upper Deschutes. Perhaps a quarter of a million horse power could ultimately be generated on the upper Deschutes during the summer only, without in the least affecting the utility of the river for irrigation. If, however, power plants should be built in this stretch of the river, and should secure vested rights to a continuous flow of water, the winter flow past these sites would be forever lost to irrigation and the full utility of the river system would be jeopardized. The development of continuous power on the Deschutes should be confined to the portion of the river below Crooked and Metolius rivers, two tributaries which receive a large volume of water at a level too low to be of any value for

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irrigation. Their flow will be augmented by the return waters from vast tracts to be irrigated from the Deschutes which will come in uniformly throughout the year from the thick lava beds, through which the waters will sink, and thus serve to render the lower river nearly as valuable for power development as it would be if the flow of its upper portion were not first used for irrigation development.

Detailed investigations have shown many interesting and valuable features of this project which had heretofore hardly been suspected. Thus a canal for irrigating Agency Plains could be used in the winter for diverting water for power

FEED CANAL, U. S. RECLAMATION SERVICE, HERMISTON, OREGON

development to a point on the edge of Deschutes River canyon, where a thousand foot head could be obtained with an almost vertical pressure pipe. All the winter flow of streams which cannot be stored and much of the return waters from the upper portions of the Deschutes project will be available for power development through this canal. There may be other projects which the state, if it undertook to develop its resources might find more favorable for first consideration, but there are none which promise greater future benefits, or a greater ultimate increase of wealth to the citizens of the state.

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JOHN DAY PROJECT.

The John Day project is another irrigation project of possibly even greater ultimate value to the State. Like the Deschutes general project outlined it is entirely intra-state with regard to location, both of irrigable lands and sources of water supply, and contains large areas of unpatented lands which justify application of Federal funds.

In round numbers this project would cover 200,000 acres of land lying along the Columbia River between Umatilla River on the east and about Willow Creek on the west. The source of water supply is John Day River which, with the exception of a few comparatively small areas in its upper valleys, cannot be otherwise used for irrigation. Economical storage sites exist both on the river itself above point of diversion and on the irrigable lands.

The available data as to water supply and surveys which have been made, though very incomplete even for preliminary studies, indicate with reasonable certainty that the project can be constructed at a cost of not to exceed $100 per acre.

Raw, unimproved lands, but with and including water right, under the Government Umatilla Project, just across the Umatilla River on the east from these lands, are selling now for $200 an acre or more, and these prices appear to be justified. The present value of the lands which would be covered by this project, exclusive of speculative value, is probably not over $5.00 per acre.

The Commission is informed by engineers familiar with irrigation investigations that a sum of not less than $100,000 will be required to make proper studies and estimates of a project of the magnitude of either of those above mentioned. If the State of Oregon should contribute half of this amount it seems reasonable to believe that the Federal Government, through its Reclamation Service, could be persuaded to allot an equal amount for the preliminary work.

The Commission therefore recommends:

1. That the State appropriate $50,000 for detailed irrigation and water power investigations on specific projects, the State to be reimbursed for the cost of any investigation by those who ultimately construct the project whether by public or private funds. The State's investments to be protected by water right withdrawals. In other words, to provide for the State systematically to promote its own development, taking up first the most feasible projects.

2. That a constitutional amendment be submitted to the people providing for a bond issue for irrigation and water power development, the cost to be made a lien upon the lands benefited or works constructed in order to insure the ultimate return of such money to the State with interest.

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THE OREGON WATER CODE.

EFFECTS OF THE LAW.

The basis for any future development of the water resources of Oregon whether by private or public funds, is the State water law.

Inasmuch as the new water code was enacted largely through the efforts of this commission, we deem it advisable to call attention briefly to the workings of this code and to outline what further legislation should, in our opinion, be enacted, in order to perfect and strengthen it.

The administration of this law has been closely watched by members of this commission, and so far as we can ascertain it has been a complete success. The law has greatly stimulated investments, as the cost of works to be constructed under permits issued by the State Engineer during the first three and one-half years, exceeded $43,863,000. If these works are constructed as planned, 961,000 acres will be added to the irrigated area of Oregon, and 176,125 additional horse power will be developed. That the promotors have some confidence in their ability to carry out these works is evidenced by the fact that $47,600 has been paid the State of Oregon prior to the issuance of these permits.

The determination and recording of early rights has progressed rapidly and the people generally recognize the great value in having the date of priority and limitations of their water rights established before the early settlers pass away, as without their oral testimony, these important facts in many cases could not be ascertained. The records now being compiled at Salem, are thoroughly indexed in a modern, business-like way, so that only a few seconds time is necessary to ascertain the details of title for any particular tract, or stream. These records, as they accumulate, are becoming of greater value each day to the prospective investor, and to the old appropriator as well. Their certainty adds value to the water right in case of sale, for record evidence of title can now be had, which was impossible under the old law.

Twenty-three separate stream systems have already been completely surveyed, involving about 275,000 acres of irrigated land. Over 2,000 separate claims to water have been filed with the Board of Control, and complete determinations made on fifteen stream systems, affecting 1068 separate rights and 106,686 acres of irrigated land. All of this has been accomplished without a single appeal to the Supreme Court and at

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a cost to the water users of only $11,175. Under the old law nearly ever water case was appealed to the highest tribunal, and its decision delayed for from five to ten years.

A sixteen page pamphlet, describing the results accomplished during the first three years operation of the water code and giving other information of value to water users, has been published by the State Engineer. It is designated as Bulletin No. 2, and entitled "The Oregon System of Water Titles". It can be had upon application to the State Engineer, at Salem, Oregon. Further details as to this work will therefore not be given here.

EXCESSIVE USE SHOULD BE PREVENTED.

The unappropriated waters of the State belong to the public. They are granted practically without charge to those who will put them to beneficial use. The supply in most localities is limited when compared with the extent of arid lands. The amount of water to be granted by the State cannot be left to the desires of the prospective water users, any more than the area of government land granted the homesteader can be left to the desire of the entryman. Some definite public policy should govern the State's action in this matter. If twice the amount of water is granted that can be beneficially used, it necessarily follows that the irrigated area and taxable wealth of the State will be reduced accordingly.

We wish to commend the State Engineer in his policy of guarding these unappropriated waters. Thus far in the granting of permits, only one second-foot for 80 acres has been allowed for irrigation purposes, whether the appropriation is by direct diversion from the stream or from storage reservoirs. This rate of flow maintained for 120 days, the average length of growing season in the dry sections of the State, will deliver three acre feet to each acre of land, or will cover each acre three feet in depth during the irrigation season. All experts and practical irrigators agree that this is sufficient to raise ordinary agricultural crops, and under most conditions more than ample.

It has been contended from some sources that a larger quantity should be allowed in cases where the water is stored by the irrigator. The fact that stored water generally costs more per acre than water from the natural flow of a stream is in itself no argument why an increased amount should be granted. In some cases the cost per acre of direct irrigation exceeds the cost per acre for stored water. Both the direct flow and the water stored in a reservoir belong to the public;

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only a right to its use is granted to the individual, and the excessive use or waste of stored water is contrary to good public policy just as much as is the waste of the regular flow.

Out of 1700 permits granted by the State Engineer, in which the rights for irrigation were limited to one second-foot for eighty acres, only four appeals have been taken to the Board of Control. In the only one of these cases, which has been decided, the Engineer was sustained. This record appears to confirm the recommendation of the experts as to a proper state policy. Out of 187 replies to a circular letter sent to actual water users throughout the State, 142 admitted that one second-foot to 80 acres was sufficient for irrigation; 18 said that this rate was insufficient; 7 expressed no opinion on the point, and 20 gave qualified answers, such as 1 to 80 was sufficient unless the applicant could prove otherwise.

Therefore if it appears advisable to adopt some definite State policy in the matter of grants to unappropriated water for irrigation purposes, we would recommend that the rate of flow be fixed at not more than one second-foot for eighty acres; and that rotation be permitted to secure an adequate irrigation head for the small user.

PROPOSED CHANGES IN THE LAW.

No radical changes in the water code should be made except upon the most thorough study and investigation. Many rights have already been settled, and recorded under its provisions, and the value of this work may all be lost in case of radical revision.

Aside from the limitation of the amount of water to be allowed, about the only changes which this commission has to suggest would be with reference to the location of the offices of the superintendents of the two water divisions, and necessary help for the Board. The superintendents, acting with the State Engineer, constitute the administrative board, having control of the waters of the State. We believe it advisable that the law provide that the new superintendents to take office January 1, 1915, shall have their offices in the capitol building at Salem. In this way, the entire board will be available for conferences on various complicated matters, at all times when its members are not absent on official business. Hearings could be had with less difficulty, and the expense of stenographic assistance, the filing of documents and records would be much lessened and simplified. All three members of the railroad commission reside at Salem, and we believe such arrangement for the water board would be more satisfactory.

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The most important change, and one which should be given careful consideration by the Legislature, is the appropriation of additional funds so that the board of control can employ necessary stenographic and other help. There was some demand at the last session for increasing the number of superintendents, so as to facilitate the work of the Board, but this does not seem to us advisable. Much of the time of the superintendents is now taken up by unnecessary routine or tabular work which could be performed by any clerk at moderate expense. It would be a saving to the taxpayers to provide this assistance. The superintendents would then have ample time to take care of the more important work. In this way the work could proceed much more rapidly than at present. A board of three, we believe, is ample for the proper administration of the water laws of this State. The maintaining of this board without adequate funds to employ sufficient stenographic help is like employing a $2400 man and compelling him to typewrite his own letters when he should attend to more important business.

The responsibilities and duties of the State Engineer have been gradually increased by the legislature for the past seven years without a corresponding increase in salary. We believe that this condition should be remedied immediately by the Legislature. In case of a vacancy, it would be impossible to find a man with qualifications to fill the office with its present duties, at the salary now provided. In addition to his general duties, the State Engineer is ex-officio chairman of the board of control, having charge of the adjudication of vested water rights involving millions of dollars; he is in direct charge of the unappropriated waters of the State and passes on questions of public policy in the granting of water permits; he directs the expenditure of State funds for topographic surveys and stream and water power investigations in cooperation with the U. S. Government and he is a member and secretary of the Desert Land Board, which has charge of the reclamation of arid lands by the State under the Carey Act.

JUDICIAL INTERPRETATION OF THE WATER CODE.

The courts have been called upon to interpret the Water Code in three different cases, and a number of important rulings have been made.

In the case of Cookinham *v.* Lewis (58 Oregon 484), the Supreme Court of the State of Oregon has construed that portion of the law relating to the granting of permits as follows:

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"It shall be the duty of the State Engineer to approve all applications made in proper form which contemplate the application of water to beneficial use, but where the proposed use * * * is a menace to the safety and welfare of the public, the appropriation shall be referred to the Board of Control for consideration. It shall be the duty of the Board to enter an order directing the refusal of such application, if, after full hearing, public interest demands."

The court held that an application which menaced either the safety or the welfare of the public could be referred by the State Engineer to the Board of Control, and that such Board could direct its refusal if public interest demands.

The question as to payment of water masters by the county was passed upon by the Supreme Court in the case of Wattles *v.* Baker County (59 Oregon 255).

A recent decision by the United States District Court for Oregon, as to the jurisdiction of that court, where citizens of different states were served with notices by the Board of Control in the determination of the relative rights to water from Silvies River, has resulted in a number of important rulings. The case was transferred to the Federal Court upon a petition for its removal, filed by the Pacific Livestock Company, of California, and the opinion handed down upon a motion to remand, filed by the Attorney General, acting on behalf of the Board. The motion to remand was allowed on three different grounds:

1. That the Board of Control is not a judicial body, but rather an administrative body, having only subordinate judicial powers. Its duties are primarily administrative. Adjudication proceedings before the Board cannot be considered a "suit at common law or in equity" within the meaning of the removable statute until the findings have been entered and filed with the Court.

2. That all claimants to the waters of a stream must present their claims to the Board of Control as provided by law, without regard to the fact that one or more of such claimants may be a foreign corporation, or resident of another state, as the cause is not one which can be decided by separate tribunals.

3. The court says, with respect to the last point, that "I am also impressed with the soundness of the view that a proceeding for the adjudication and determination of the rights to the use of the waters within the State, instituted and conducted as provided in the legislative act of 1909, is in effect a proceeding on behalf of the State through an administrative or executive

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board to have judicially settled in an economical and practical way, the rights of various claimants to the use of the waters of a stream or source of supply, and thus avoid the uncertainty as to water titles and the long and vexatious controversies concerning the same which have heretofore greatly retarded the material development of the State."

The constitutionality of the water code has not, as yet, been questioned in our courts. It is believed that the last case above mentioned, together with the Wyoming case of Farm Investment Company *v.* Carpenter (61 Pacific 276), and the Nebraska case of Crawford *v.* Hathaway (93 Northwestern 795), settle, beyond question of doubt, the constitutionality of the law. The Wyoming and Nebraska water laws are similar

BENHAM FALLS, IN DESCHUTES RIVER—CROOK COUNTY

in many respects to the Oregon law, and are supported under the police power of the state to regulate streams to preserve the peace and safety of the people. It is not necessary that one be a water user to know something of the litigation, strife and bloodshed which annually occurs on many streams where no public administrative system is provided to distribute water.

With the growing importance to the State of irrigation and water power matters, we therefore recommend that the salary of the State Engineer be fixed at an amount commensurate with the duties and responsibilities of the office, and that additional funds be provided for the Board of Control in order that the work of determining and recording old water titles may keep pace with the demand.

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WATER POWER.

Using steam engines of large capacity one hundred and forty-five millions of dollars worth of coal would be consumed annually in producing the 3,300,000 horsepower which is undeveloped and running to waste in the streams of Oregon. It takes from 11 to 15 tons of high-grade stream coal per year to produce 24 hour power in the most efficient steam engines in ordinary use. The above statement is based on the smaller figure, with coal at $4 per ton.

The undeveloped water power of Oregon is clearly far in excess of the prospective needs of the present generation, judging from the fact that "the total power used at the present time in New York State, exclusive of locomotive engines, does not exceed one million horsepower", as reported by the New York Conservation Commission. We have, therefore, not attempted to revise the figures given above, which were presented in detail in our first report, although additional data on some of the less well-known streams might justify some increase in the above values.

We believe that the water powers of Oregon, if developed and put to use, will exert a greater influence upon the development of our State than the production of 36,000,000 tons of coal annually, which is the amount necessary to be consumed to produce an equivalent power by steam engines. Where 11 tons or more of $4 coal is now consumed to produce one horsepower per annum, we believe that ultimately the same amount of electrical energy measured at the generating station, can be produced from water at an annual cost equal to that of two to five tons of coal.

PUBLIC BENEFIT.

Notwithstanding the fact that we have vast quantities of undeveloped power in Oregon, we find that we are getting no appreciable benefit in the form of reduced rates, when compared with other less favored states. It will be our purpose, in this report, to point out a method whereby it is believed citizens of this State can secure electrical power at lower rates than now prevail, thus giving to Oregon an advantage impossible to be offered by other states not so abundantly blassed in water power resources. In this effort we feel that we are carrying out the work for which this commission was created, that is, to promote the highest and fullest use of our natural resources.

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COST OF POWER.

The annual cost of producing 24 hour power, in simple, slide-valve, non-condensing engines, using return tubular boilers, according to Mead, varies from $106 to $182 per brake horse-power, or power measured at the engine shaft. This is in small units of from 10 to 50 horse-power. In large units of 1,000 horsepower, or more, using water tube boilers with reserve capacity and compound Corliss condensing engines or steam turbines, the cost of 24 hour power is given by other good authority at from $60 to $80 per brake horse-power. This includes interest at 5 per cent, depreciation, repairs on plant, oil, and waste, labor and fuel, using coal at $4 per ton.

Water power must, of course, compete with steam or other forms of producing power. It will, therefore, remain undeveloped unless it can be disposed of at less cost, except for the higher price certain customers will pay for the convenience of obtaining such power when transformed into electricity.

It costs from $60 to $200 per horse-power, measured at the turbine shaft, to construct the water power plant ready to deliver electrical power. This power can, of course, be sold in the vicinity of the power plant at less cost than if transmitted long distances. It is now possible to transmit power economically to points 250 miles from the power plant. The cost of transmission including transmission losses, will make the power more expensive at the other end of the line.

According to the Ontario Hydro-Electric Commission, if it costs $86 per brake horse-power to construct a hydro electric power plant, the resulting power can be sold at the power plant at $8.32 per horse-power per annum. This is for power delivered at the high tension buss bars of the station, and covers operation expenses, depreciation, repairs, sinking fund provisions, and four per cent interest on the money invested.

To serve an individual customer using 300 horse-power two miles from the station would add $2.75 to the above annual charge per horse-power, or $4.40 if he is 6 miles distant, according to the same authority. If his factory was from eight to fifteen miles distant, from $5.50 to $8.30 would have to be added to the above charge of $8.32. A rate of one cent per killowatt hour is equivalent to $65.70 per horse-power per annum.

U. S. Consul, T. H. Norton, states that "in Sweden, the cost per annual horse-power is apt to range above 50 crowns, or $13.40. In Norway, rates vary usually between $5.40 and

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$10.70. There are some cases where the cost is even as low as $4.00."

PUBLIC REGULATION IN ONTARIO.

To prevent a threatened water power monopoly and to reduce electric rates, the Province of Ontario, Canada, created a hydro-electric power commission in 1906, with full power to construct plants and to buy and sell power. This Commission is now operating 300 miles of 110,000 volt main transmission lines, and 180 miles of distributing lines, buying current from the Ontario Power Company, a private corporation at Niagara Falls, at $9.00 per horse power per annum. The rates charged the municipalities to cover cost, vary from $18.00 to $29.50 per horse-power per annum, according to distance, and the Commission is supplying at present, thirty municipalities, including the City of Toronto, with a population of 400,000, Ottawa with 90,000, Hamilton with 82,000, and London with 48,000.

The City of Toronto, located approximately 90 miles from the power plant at Niagara Falls, is able to purchase 10,000 horsepower from this Commission at $18.50 per horse-power per annum for 24 hour power.

To produce this power by steam plant would probably cost at least $50 to $60 per horse-power.

Private capital invested in hydro-electric plants has shown a remarkable tendency to combine owing to the economies in having many plants tied into one transmission system. This is the first instance where those who believe in municipal ownership of public utilities, have shown a tendency to unite to secure those benefits which are impossible to secure when operating on a small scale. The Province develops, or up to the present time purchases, power in wholesale blocks and transmits it over public wires to the various municipalities where it is distributed by the city authorities.

POWER RATES.

The Conservation Commission has not had an opportunity to prepare any comprehensive statement of comparative rates for electric service in various municipalities in Oregon and other states. Such rates are based on the class of service, whether for lighting or power, the connected load, and the load factor, or portion of the whole time during which energy is being used. It is believed that rates in Oregon will compare not unfavorably with those in other communities under similar conditions.

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Wholesale prices often have relatively little relation to retail charges for such classes of service as residence lighting, where the distribution and commercial features introduce by far the largest item of cost. In the case of industrial power or even of commercial lighting in large establishments, variation in the cost of generating the energy is felt more markedly. But the industries which will be affected the most by very cheap power on a large scale are those using enormous amounts of energy continuously throughout the year. These include the electro-chemical industries, such as the production of nitrates, cyanamide, oxalic acid, and aluminum, electric smelting of iron, steel and copper, and in some degree the manufacture of wood pulp.

EFFECT OF CHEAP POWER IN NORWAY.

Cheap power has had a most wonderful effect upon the recent development of Norway and Sweden. With respect to Norway, Mr. Norton states:

"It is in the recent establishment of electrochemical industries upon a grand scale that Norway has disclosed her latent power as a coming factor in the field of applied chemistry. The vast, hitherto almost neglected, water power is now being harnessed, one factory after another is coming into existence, and soon the Kingdom will present a remarkable exhibit of varied chemical industries, contributing largely to the world's markets and enriching rapidly the land.

"This change began in 1899 when the first calcium carbide factory was built. The number of works has steadily increased until now there are seven in operation. In 1905, the first air-nitrate works began operation. Now a second on a much larger scale is about to open, and others are planned. In addition, there is a factory for cyanamide, one for sodium, one for aluminum, one for nickel, one for ferrosilicon, and one for electrosteel. There are also several smaller experimental plants. The products of these factories exported in 1910 had the following values: Calcium carbide, $1,627,000; calcium cyanamide, $148,000; calcium nitrate, $507,000; sodium nitrate, $58,000; sodium nitrate, $309,000; aluminum, $437,000; sodium, $63,000; ferrosilicon, $192,000; total, $3,377,000.

"The exported products in the above categories were valued at $2,717,000 in 1909. The annual increase at present in the value of electro-chemical products, as far as it can be measured by export statistics, is thus $660,000.

"In surveying the chemical industries of Norway there are several features worthy of careful study by the American

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economist. First and foremost is the systematic and exhaustive manner in which the abundant water power of the country is now being regulated, stored up, and pressed into the service of the steadily increasing group of electrochemical industries. The best talent in the nation is enlisted in this cause, and the way is rapidly being opened for Norway to assume an industrial position commensurate with its geographical size and admirable facilities for maritime transportation.

"In another field Norway has shown her ability to develop an industry, fitting in well with her enormous lumber interests, and that is in the manufacture of oxalic acid. It is a source of wonder that no attempt has yet been made to organize this branch of manufacture in the vicinity of some of the great American lumber centers, where sawdust, the primary raw material, is without value, except as fuel. The United States buys annually oxalic acid from Norway to the value of $43,000, and from Germany to the value of $65,000. The American market should not be dependent upon European manufacturers for a chemical the preparation of which is so comparatively simple."

CHEAP POWER IN SWEDEN.

Consul Stuart J. Fuller of Gothenburg, states in the Consular Report of April 1, 1912, that there is more than two million undeveloped horse-power in the streams of Sweden. Also that cheap water power has been a leading factor in the recent unusual development of that country.

"It is estimated that the water power in Sweden utilized in accordance with modern methods increased in 1911 by some 80,000 horse-power, aggregating at the close of the year 640,000 horse-power. The value of this power to the nation and its influence in the rapid industrial development going on in Sweden are incalculable.

"Water power developments here are of two classes: Those controlled and operated by the State and those controlled and operated by private interests. Of the increase for the year, 70,000 horse-power was made available by plants privately owned, and 10,000 in the Trollhattan plant, owned by the State. The activities of the Government were largely devoted to the earlier construction stages of two large installations in the north, which together, will furnish 95,000 horse-power when completed, so that the ratio of public to privately owned power actually made available during the year does not constitute a measure of these respective activities. As a matter of fact, the 70,000 horse-power includes many small plants of

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less than 100 horse-power each, embracing only two installations of 10,000 horse-power or more and only five of over 2,000 and less than 10,000.

"The uses to which the power made available during the year and to be made available by plants begun within the year is to be devoted are as follows: Municipal, 13 plants; iron works, 12; mechanical wood-pulp mills, 8; paper mills, 7; textile mills, 5; chemical works, 1. The Government work completed at the end of the year consisted of the addition of 10,000 horse-power at the already existing plant at Trollhattan.

"In addition to its general uses for operating machinery and street cars and for lighting, electricity is used in Sweden in rolling mills, mine hoists, mine drills, magnetic-ore separators, the electrochemical industries (which use large quantities), and the smelting of steel. Lately it has also been used for the reduction of ore to pig iron. The large quantities available have led to its use for the operation of agricultural machinery, thrashing machines, etc., and it is proposed to equalize the consumption throughout the 24 hours in cities by selling power at very low rates during the hours when the load is low, so that it may be introduced into the household for heating, cooking, and other domestic purposes for which, under ordinary rates, it is too expensive for general use. The transmission of power from Trollhattan to Copenhagen has been proposed and is still under consideration.

"The height of the falls utilized varies from 7 to 243 feet, but was as a rule less than 50 feet."

CHEAP POWER IN OREGON.

If it could be announced to the world that almost unlimited power could be had in Oregon at from $8 to $15 per horse-power per annum, we believe that development would be unprecedented, in view of the prospective reduction in freight rates through the Panama Canal to markets bordering on the Atlantic Ocean.

The trade rates of the world must be readjusted upon the opening of this canal. It may not be generally known that a steamship going the great circle route from Liverpool to Japan will pass within one days trip of New York, and on the Pacific, come within two or three days travel from Portland. This insures frequent calls from tramp steamers returning empty and opens great possibilities for manufacturing establishments in Oregon where power, timber, and other raw products are abundant and cheap. Because of this readjustment, the time seems to us ripe for branching out into new lines which heretofore have been considered impractical.

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We are advised by competent engineers that about 550,000 horsepower can be developed through the construction of fourteen dams in the Dechutes River Canyon, averaging about 97 feet in height, at a cost of $60 to $80 per brake horsepower. About 500,000 additional horsepower can be developed at Cascade Locks, and Celilo, on Columbia River, at perhaps even less cost. These latter developments would also make available, during high water, about 400,000 additional horsepower for from five to ten months of the year at the cost only of installing machinery or from $25 to $30 per horsepower. In addition to this, there are several hundred thousand horsepower on upper Deschutes River, which will be developed incidental to irrigation, and will be available from four to six months of the year.

If it costs $80 per horsepower to develop this power, we believe it can be sold in the vicinity of the plant for about $8 to $10 per horsepower per annum, judging from the Ontario figures and making necessary allowances for differences in conditions in the east and west.

The State is now cooperating with the United States Geological Survey in a survey and report on the water power possibilities of Deschutes River, and we are informed that this report will be finished by January 1, 1913, and available thereafter as soon as it can be edited and printed. We believe this report will confirm the figures given above, and include detailed figures showing that water power can be generated in Oregon at a cost which will compare not unfavorably with that in Norway and Sweden.

PRIVATE DEVELOPMENT AND CONCENTRATION.

It is each year becoming more hazardous for private capital on a small scale to engage in the development of water power projects unless some understanding or arrangement has been made with the larger combinations who are now securely intrenched in the various districts. The Commissioner of Corporations of the United States is authority for the statement that ten private interests now control about 60 per cent of the total commercial power in the United States. He states further:

"This great concentration movement is in a field where the public is peculiarly interested. Power is at the foundation of modern industry. The facts raise these questions, (1) The best development of our water resources. (2) The protection of the consumer, and (3) The securing for the whole public of its proper share in the advantages inherent

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in the natural resources itself. The need for water power development is obvious. The non-use of water power means diminution of our other sources of power. The water power now in use saves at least 33,000,000 tons of coal annually. Prompt utilization is therefore essential, but it must be frankly recognized that the most efficient use of water requires a considerable degree of unified control. Certain highly monopolistic tendencies are inherent in the water power industry, largely centering around the expensive fixed investment in transmission and distribution lines. Our public policy must recognize both the need for utilization, and the dangers of monopolistic control, and take effective action on both."

PUBLIC DEVELOPMENT.

The Federal Government is already committed to the policy of using its resources to promote irrigation in the same field with private capital. Private capital has not been driven from the field, but on the whole has been greatly stimulated to new efforts through the advertising and popularity of the movement which has resulted through the adoption of this Governmental policy.

The State is already committed to the policy of irrigation under the Carey Act, employing private capital somewhat indirectly. It is now operating a state constructed railway at Celilo as a regulator of freight rates. Many of our cities have engaged in public enterprises such as municipal water works, and electric light plants. In New York State, more than 75 per cent of the cities containing 90 per cent of its urban population, are supplied with municipal water.

The trend of public policy is toward an increase of this work, rather than a decrease. One does not hear of any cities returning to private ownership of water supplies.

Private capital will not lead the way to lowering prices, trusting to an increase of profit through increased sales at lower rates, nor will it pioneer the way through the development of power in advance of a market.

The public, operating without profit, and paying low interest could afford to do this to encourage immediate development on a large scale. The burden could be distributed over a period of thirty to fifty years and would be small, as the hydraulic and electric machinery which is the largest item in most developments, need not be installed until the market is found.

THE RESULTS OF PUBLIC CONTROL.

As a result of the pioneer work of the Ontario Hydro-Electric Commission, and the low prices due to this provincial

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enterprise, electric lights are found in about 98 per cent of the city homes in this Province. The electric light companies, of this Province, have more than one customer out of every five inhabitants, while in Utica, N. Y., where there is no competition with public funds, the ratio is 1 out of every 18 inhabitants. In Albany, N. Y., it is 1 to 20, and in Troy, 1 to 31. In Buffalo, which Niagara Falls was to make the electric city of the world, the ratio is 1 to 37; in Rochester, 1 to 26; although the private company owns and operates 90 per cent of the huge water power within the city. In New York City, the ratio is 1 to 35. These ratios are maintained in all the cities of New York State according to Chairman Van Kennon of the New York Conservation Commission, who states:

"It appears that the cost of light and power in the Province of Ontario has been reduced about one-half as the result of the introduction of the construction through public funds, and the problem of municipal lighting has been solved thereby.

"We have been surprised to learn", says Mr. Van Kennon, "that in those cases where private companies have adopted proper methods, met the price fixed, and rendered efficient service, the volume of business was largely increased, and they are more prosperous than before the advent of the Hydro-Electric Commission."

The chairman of the Ontario Commission, in discussing the effect upon vested interests, states, in concluding a detailed discussion, that "the smoke of battle has gathered mostly over the head of the Electric Development Company. If this company had been injured in any degree by the Commission, the market price of its bonds would reflect the injury. On the contrary, they have steadily improved in value."

Chairman Van Kennon of the New York Conservation Commission, states:

"I would consider it unwise for the ordinary municipality to construct a plant designed only to furnish light for its public streets and buildings. The capital invested in a generating plant, the cost of production of electricity with coal, and the limited service, would make the venture hazardous from a financial standpoint.

"The plan of the Conservation Commission would obviate some of these difficulties. The expense of a generating plant would be eliminated, the cost of production reduced, and the service enlarged to include not only light for public streets and buildings, but also for domestic and commercial use, and power for traction and manufacturing purposes. Such diversified service would tend to equalize the load, and reduce to a minimum the cost to the different classes of customers. This

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plan would, in addition, serve to regulate the business methods of the existing companies. As a rule they now feel that they are clothed with the divine right to charge all the traffic will bear. Volume of business is sacrificed to the main purpose of sustaining prices. Large sales and small profits, is a rule not found in the lexicon of light producers.

"Our plan would result in a change of this policy, because the cost of production is the basis upon which the charge for electricity is made. The volume of business would naturally increase as the price diminished. Electric lights would replace all other means of illumination, and electricity would tend to supplant other forms of power production."

The effect of the municipal ownership at Seattle and Tacoma, appears already to have had considerable effect on the use of electrical energy per inhabitant for light and power as compared with Portland. For the central Puget Sound region, the kilowatt hour consumption per inhabitant for light is 197 and power 172, as compared with Portland, light 146, and power 157.

DEVELOPING THE POWER MARKET.

With power development by the State, or the various states, in cooperation with the United States, the cheapest power would be developed first. The cheapest power projects are usually the largest projects, and those to be taken up last by private capital. They prefer to construct small units, although the first unit cost is higher, rather than one involving a large initial but low unit cost and which far exceeds the present power market. With power furnished at cost, great blocks could be sold in the near future, to fertilizer works such as those now operating in Norway, for the electric fixation of atmospheric nitrogen, for iron and steel works, for copper reduction works, for aluminum, carborundum, carbide, and other works employing large quantities of power at low cost, and also for the heating of houses and cooking purposes. No one of such factories will take the initial risk of developing a power project far beyond its needs, in order to secure cheap power in Oregon. The public must lead the way if we expect to secure any benefit from cheap power. With cheap power in Oregon, innumerable enterprises employing large amounts of capital and labor, will spring up and cause, we believe, unprecedented prosperity.

PUMPING FOR IRRIGATION.

Cheap electrical power for pumping purposes would greatly stimulate the reclamation of public and private lands on both

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sides of the Columbia River, in Oregon and Washington, as well as along every other stream or lake where transmission lines are located. It would be available for every other purpose on irrigated farms throughout the year—this would make country life more attractive.

Irrigation by pumping, although possible for low lifts under present prices, is greatly retarded through fear that the power rate will be advanced at the expiration of the original short time power contract. Gravity irrigation did not become a success until the ownership or control of both land and water were united in the same person. All modern water laws for this reason make water appurtenant to the place of use. For a pumping project this is not possible unless the owner controls, not only the land and water, but also the source of power.

If, under present power prices, irrigation by pumping is a commercial success for a lift of 100 feet, water could be pumped to land 300 feet above the stream with power furnished at about one-third the present price.

The pumping rate for power through central Washington for an installation of less than 25 horsepower, is given by G. C. Arrowsmith of North Yakima, as $42.00 per horsepower for a six months irrigation season. This rate he regards "as fair to the consumers and as low as is compatible with good business for power companies to make", and which rate he "believes will remain fixed for some time to come". With power supplied at $25.00 per horsepower per full year, which is possible within a considerable disatnce from the public plant, judging from the experience of the Ontario Power Commission, water could be pumped 300 feet in elevation and a much greater area of arid land brought under cultivation.

CONCLUSIONS.

We believe, in conclusion, that the State acting alone, or better, acting in cooperation with other states and with the nation, must pioneer the way and assist in the construction of those large irrigation and water power projects which are beyond the ability of private capital to construct.

We believe that this is an economic, and not a political question; that the State must pursue the policy of developing these natural resources for the benefit of the people, or surrender the same to private interest, to be monopolized and exploited for the enrichment of the few at the expense of the many.

We believe that our enormous water resources belong to the people, and should be developed by the people and for the people.

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LAND AND STREAM SURVEYS.

The Commission, in its earlier reports has repeatedly called attention to the urgent need of securing more complete data in regard to Oregon's streams and the making of more topographical maps of irrigable valleys and of the headwater basins of streams available for irrigation.

It was in no small measure as a result of these recommendations that the State legislature in 1911 passed a law appropriating $20,000 per year for hydrographic and topographic surveys in cooperation with the United States Geological Survey. This is in addition to the appropriation of $5,000 a year made for similar purposes by the 1905 legislature, thus making available a total of $25,000 of state funds, contingent upon the Director of the Geological Survey alloting an equal amount. This was done and in 1911 the total expenditure within the state was $50,000. The work to be undertaken was determined upon in conference by the State Engineer and representatives of the Geological Survey. It was decided to increase the work of stream measurement to a considerable extent; actively to prosecute the topographic mapping in the Willamette Valley, and certain other portions of the State, to make special power surveys of the Deschutes River, and a general chemical survey of the streams of the State.

The allotments from the two funds for the various classes of work for 1911 were as follows:

Class of Work	State	Federal	Total
Topographic maps	$16,500 00	*$13,500 00	$ 30,000 00
Stream measurements	6,000 00	6,000 00	12,000 00
Deschutes power survey	1,500 00	4,500 00	6,000 00
Chemical survey	1,000 00	1,000 00	2,000 00
Total	$25,000 00	$25,000 00	$ 50,000 00

* After deducting $3,000.00 expended on topographic surveys in connection with the Deschutes River work.

In 1912 there was available in addition to the regular state appropriation, the sum of $3,000 from the Survey fund derived from the license tax on water power development, making a total of $28,000, which has been met by an equal allotment of Geological Survey funds. The allotment for 1912 will be substantially as follows:

Class of work	State	Federal	Total
Topographic maps	$15,000 00	$15,000 00	$ 30,000 00
Stream measurements	8,650 00	8,650 00	17,300 00
Deschutes power survey	3,000 00	3,000 00	6,000 00
Chemical survey	1,350 00	1,350 00	2,700 00
Total	$28,000 00	$28,000 00	$ 56,000 00

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TOPOGRAPHIC MAPS.

The preparation of the quadrangle units of the topographic map of the United States Geological Survey has gone forward rather slowly in Oregon until the last two years. With the increase of funds available for the work, the number of parties that can be placed in the field each season has been about trebled. The mapping of the Willamette Valley on a large scale is progressing at an encouraging rate and bids fair to be completed by the end of 1914. The Pine quadrangle, lying just east of Baker in eastern Oregon, will be completed in 1912. This will show the Lower Powder and Eagle valleys and the drainage basins of streams tributary to them. Work has also been commenced on the Arlington quadrangle, which will cover an area west of the Blalock Island sheet, including some of the land embraced in the proposed west Umatilla and John Day irrigation projects.

STREAM MEASUREMENTS.

The number of stream gaging stations maintained in the state has been increased from 87 in September, 1909, to 112 in September, 1912, an increase of 25, or 35 per cent.

The new stations have been established for the most part to furnish data in regard to irrigation possibilities, although the measurement of power streams has by no means been neglected. A considerable amount of new work is being done in the Rogue and Willamette River valleys, on the upper tributaries of the Deschutes and on streams tributary to the lakes of the Great Basin. The increase in funds available has made possible a marked improvement in the accuracy of the work.

Without the additional data which has been obtained during the past two or three years in regard to stream flow, no such estimate could have been made of total water supply in the State, as is given on page 36.

DESCHUTES POWER REPORT.

The importance of Deschutes River and its permanent value to the State of Oregon, both for irrigation and power, seemed to justify the special detailed investigation of its water resources, which was commenced in 1911. During that season a profile survey was made from the mouth of the river to the head of Benham Falls. In this portion of its course the Deschutes River has a fall of 4060 feet in 181 miles. The Benham Falls reservoir, the largest in the State, was also surveyed. In 1912 a profile of Metolius River has been run from the mouth to Suttle Lake, and detailed surveys of several damsites have been made. A complete report on the water

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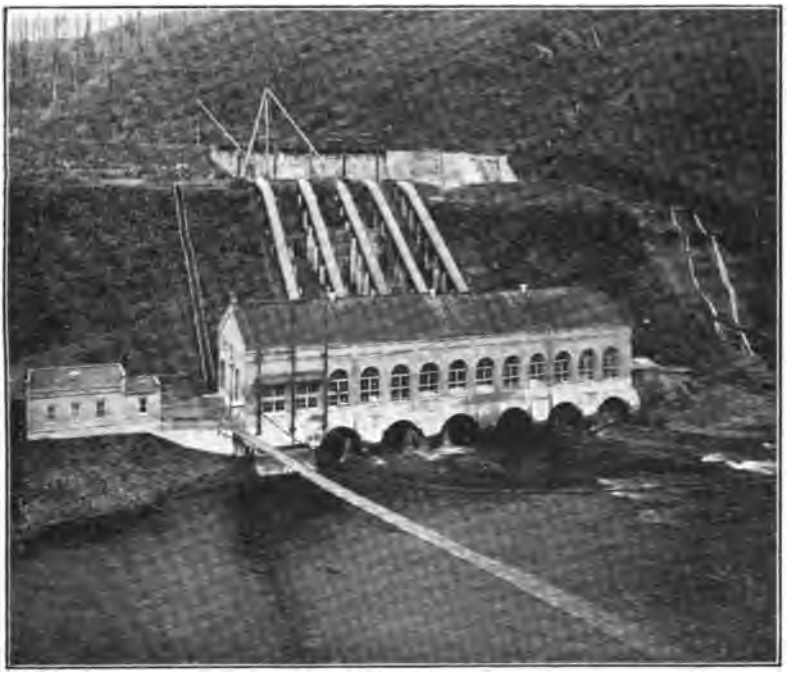
powers of the Deschutes will be completed and ready for distribution in the early part of 1913.

CHEMICAL SURVEYS.

The quality and chemical composition of the water of a stream may affect its availability for use as a domestic supply, for boilers, manufacturing and other industries and for irrigation. In order to determine the fitness of the state's waters for these various uses, a chemical survey was undertaken by the Geological Survey. Daily samples have been collected at 24



CAZADERO PLANT ON CLACKAMAS RIVER

points on 21 rivers in the State for a year, and analyzed in groups of 10 days.

In all 842 separate water analyses have been made in the laboratory at Salem. Of these 808 were for river waters and involved the search in each case for nine or more minerals in solution, in addition to the determination of color, turbidity and total solids.

A report embodying the results of the study will be available some time in 1913.

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MINERAL RESOURCES.

The tabulation of the mineral production of Oregon for 1911 by the United States Geological Survey is not entirely complete at this date, but indications go to show that it will not be materially different from that of 1910. During this year a little less than $4,000,000 worth of geological products was produced in the State, the most important being coal, building stone, lime, gypsum, sand and gravel, clay and clay products, mineral waters, and the metals, gold, silver and copper. There are latent possibilities of developing oil and gas, cement, aluminum, iron and salines.

In 1910 over $12,000,000 worth of geological products were brought into Oregon from other states. Probably three-fourths of this amount could have been produced within her borders, according to a report of the State Bureau of Mines, entitled "The Economic Geological Resources of Oregon." A brief summary of the developed and undeveloped mineral resources will be abstracted from the report referred to.

NON-METALLIC PRODUCTS.

The only productive coal field in the State is in the Southwestern part, in Coos County, what is known as the Coos Bay Field. In this region there were produced in 1910, 67,553 short tons of coal having a value of $235,229. Most of the coal in this field is lignitic in character, some of the best quality is regarded as sub-bituminous. Transportation is confined exclusively to Coos Bay and the Pacific Ocean, and San Francisco is the principal market.

The building stone industry in Oregon is assuming considerable proportions. The total value of various kind of stone produced in Oregon in 1910 was $1,108,478. This included rough and dressed building stone, dressed monumental stone, crushed stone for road building, flag stone, curbing stone and paving blocks. The crushed stone used for street pavements is by far the most important of the above items. Multnomah and Washington Counties are the greatest producers of sandstone largely on account of the demand for such materials in the City of Portland. The products from these counties amounted to $24,825 in 1910. Jackson and Lane counties producing $3,594 worth in 1910.

Granite is found in a limited number of localities. The most important bodies lie in an area of crystalline rocks in Jackson, Josephine and Douglas counties, in the southwesterly portion

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of the State, and a similar area in the Blue and Wallowa mountains in Baker, Grant, Union and Wallowa counties. In 1910 Oregon stood seventh in the list of states in point of production of granite building stone, California being the only western state which exceeded it.

Limestone occurs in points widely separated, large deposits are found in the southwestern and northeastern portions of the State. Further geologic investigation will no doubt reveal deposits in many other localities. In nearly all the area where limestones are reported, there are abundant supplies of clay or shale which could be used in making cement. Suitable fuel, however, is scarce except near the coast, where low priced oil from California can be obtained.

Gypsum occurs in Oregon in two localities, one in the eastern part of the State near Huntington, which has been developed, and an undeveloped deposit near Bend.

The sand and gravel industry is very closely allied to the building stone industry and is assuming very important proportions. Large quantities of gravel are used in concrete work in most localities in the State. The total production in 1910 was 1,145,966 yards having a value of $625,405. Fortunately few states have a better distribution of this valuable structural material than has Oregon. The Willamette River has a inexhaustible deposit and will supply the Willamette Valley indefinitely. There are only seven States in the Union that used more gravel in 1910 than Oregon. Portland was the second city in the United States in the cost of concrete construction in that year, Chicago being first, San Francisco tenth and Seattle thirteenth.

The total production of clay and clay products in Oregon was $912,016 in 1909 and these constitute a not inconsiderable portion of the State's output of geologic products. These include common, face, and fire brick, drain tile, pottery and sewer pipe which are produced in widely separated parts of the State.

In the interior basin of Central Oregon there are a number of alkaline lakes in the waters of which have been concentrated by long evaporation a complex of saline compounds, including potash, common salt, borax, soda and possibly other salts.

Analysis of Summer and Abert Lakes, for instance, show a large percentage of sodium carbonate in their dissolved matter, sufficiently high in fact so that upon becoming saturated by evaporation, trona, a hydrated sodium carbonate is precipitated in an almost pure form. Certain conditions of temper-

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ature and concentration are necessary to obtain the highest grade of product.

METALLIC PRODUCTS.

The aggregate amount of the mine production of gold, silver and copper in the State in 1910 was $700,676. The production was derived from 180 mines of which 116 were placers and 64 quartz mines. The metal mining industry in the State of Oregon is just now passing through a transition period between the placer stage and quartz mining stage incident in the history of most mining countries. The placer production for a number of years has been gradually diminishing while the production from the deeper mines is increasing, until in 1910 the deep mine production exceeded the placer production. Development work on deep mines in a few localities has been going on steadily for the past few years and especially in eastern Oregon, there are a number of properties which will very materially increase the gold production of the State in 1912 and 1913.

Aluminum is the most widely distributed of all metals. Its admirable qualities of lightness, strength, and resistance to corrosion would render it one of the most widely used of metals, if it could be produced as cheaply as iron. But while oxides of iron can be readily broken down in the ordinary blast furnace, aluminum cannot be separated from any of the elements combined with it in an ordinary furnace using coke as a reducing agent, but in the form of oxide bauxite it must be subjected to the very high temperature of the electric furnace. To create this extreme heat requires a large amount of electrical energy and it is necessary to ship the ore to a point where abundant cheap power is available. If it is possible to produce cheap power in large quantities in Oregon, the aluminum industry may become an important one in the State.

DEVELOPMENT REQUIRED.

The foregoing summary indicates that Oregon possesses a considerable diversity of minerals both developed and undeveloped. But the production in many important cases shows a falling off instead of a gain and development is not being carried actively forward in exploiting many other important mineral deposits.

Thus in the case of cement, it is estimated that in 1907 there was imported into Portland from foreign countries and California a total of about two-thirds of a million barrels of cement. Reliable figures for later years are not

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available, but building activities around Portland have increased measurably, and the present consumption has been estimated at 1,200,000 barrels annually. The average price per barrel received at Pacific Coast mills in 1910 was $1.38, while the cost to the consumer averaged about $3.90 in the eastern part of the State and about $2.00 at Portland. The difference between $1.38 and the latter figures represent largely transportation costs.

Concrete construction is everywhere replacing wood for manufacturing and commercial structure and engineering work of all kinds, and in the not distant future bids fair to displace wood in the construction of dwelling houses, and to establish itself in a variety of uses on the farm.

Cement construction has the great advantage of being fireproof and permanent and its use will have a strong tendency to aid in the preservation of our forests by replacing wood for many important uses.

The State of Oregon has never taken any steps to determine the amount of her mineral or geological resources except what small amount has been expended through the United States Geological Survey. This has been decidedly fragmental and deals with only four small localities in the State, namely: small areas in Baker, Coos, Curry and Douglas counties. Until within the last two years Oregon was one of only four or five states in the Union which has made no provision for a Geological Survey, or an equivalent organization.

In 1911 the legislature passed a law creating the Bureau of Mines of Oregon, and providing that its work should be carried on in connection with the State Agricultural College at Corvallis. An appropriation of $1000 per annum was made for carrying on its investigations. This sum is wholly inadequate to cover all the investigations and duties with which the bureau is charged. The work of the bureau, on account of the limited funds available, has of necessity been of a general nature. Two creditable reports have been issued, one on the "Road Materials in the Willamette Valley," and one on the "Economic Geological Resources of Oregon," a compilation of valuable information which hardly attempts to more than briefly outline possibilities.

The state of Washington appropriates for its Board of Geological Survey the sum of $10,000 annually, to be used in investigating its mineral deposits, and produces about $17,000,000 annually of geologic products. This is an addition to an appropriation of $18,750 annually which is spent under

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the direction of the Board for cooperative work with the U. S. Geological Survey. California spends $30,000 annually through its State Bureau of Mines, besides about $10,000 for printing, and the State has an annual mineral output of about $86,000,000. Oregon has to date spent less than $2,000, altogether, in the work of its mining bureau, and its annual production in 1910 was only about $4,000,000. Oregon lies between the two above mentioned commonwealths and partakes of generally similar geologic structures. There would appear no good reason why the tardiness of development of this State's mineral resources should be so marked except the lack of intelligent and systematic information as to their extent and availability.

The work carried on under the direction of the Board of Geological Survey of Washington during the biennium 1909-1911 comprised investigations of coal fields in cooperation with the United States Geological Survey, studies of Portland cement materials, metal mining districts, soil surveys in cooperation with the Bureau of Soils of the United States Department of Agriculture, and investigation of road materials in which the office of public roads of the same department assisted.

Thus with an expenditure of $20,000 by the state the federal bureaus contributed during the two years 1909-1911 a total of $10,986.21 as follows:

U. S. Geological Survey for coal surveys	$ 2,047.26
Bureau of Soils, logged off land surveys	8,938.95

Thus the State through cooperative agreements obtained the benefit of expenditures by the federal government over one-half as great as those from its own funds.

RECOMMENDATIONS.

The Commission believes that the interests of the State will be best conserved if much of the work of this character is carried on in cooperation with that of Federal Bureaus engaged in similar investigations. The Geologic Branch of the U. S. Geological Survey comprises a corps of trained economic geologists who are experts along their special lines and are doing the highest grade of work that is being done in this country.

Soil surveys of the irrigable valleys, and the logged off lands of the State are needed. The soil experts of the Bureau of Soils of the U. S. Department of Agriculture have been carrying on the work of soil surveys, analysis, and classification for years and have developed the most efficient and scientific

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methods. By entering into cooperative agreements with the Survey, the State of Oregon could avail itself of the service of these trained workers.

The organization of the present Bureau of Mines of Oregon, as a part of the State Agricultural College, seems hardly adequate for the accomplishment of all the purposes which a properly equipped bureau should undertake. In general, it has been the experience of other states that the disadvantages attendant upon making such a department subordinate to any one educational institution more than offset any benefit effected thereby. The work of investigating the State's mineral resources should preferably be under the supervision of a non-political board representing as many as practical of the interests involved. For this purpose the Commission suggests a State Board of Mines and Geology consisting of the presidents of the State Agricultural College and the University of Oregon and of three members which might well be designated by the State Mines Association and the Oregon branch of the American Mining Congress.

To this board should be delegated the general oversight of the mining and geologic work of the State. They should be empowered to appoint the director, or equivalent officer who will have the immediate direction of the investigations, and upon his recommendation to appoint such assistants and employees as may be deemed necessary and to fix their compensation.

For a time at least, it would probably be to the advantage of economy to have the director and some of the employees of the bureau appointed from the Mining and Geology departments of the State College and University and perhaps to specify that the purely administrative duties of such officials shall be carried on without extra compensation. The Board of Mines and Geology should be empowered to enter into cooperative agreements with the U. S. Geological Survey, Bureau of Soils and such other Government Bureaus as they may deem it advisable. The Commission also recommends that the sum of $20,000 per annum be appropriated for the work of the board of which not less than $10,000 should be used for cooperative work, the remainder to be available for work of a character which may be more advantageously carried on by the members and employees of the bureau itself.

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WATER TRANSPORTATION.

Transportation in every form is a matter of interest to the citizens of Oregon. It is hardly necessary, however, for this Commission to enter into an extended discussion of the use of water as a transportation agency. In general the improvement of our rivers and harbors is under way, or projects looking to such improvement are under consideration. The approaching completion of the Panama Canal has awakened a new and keen interest in such work.

Co-operation between the State and the Nation in transportation matters is, however, well worthy of note. We believe this State has carried out the policy of co-operation more systematically and more generally then any other state in the Union. Through municipal organizations created by law, and given power to tax and to issue bonds as authorized, nearly every harbor in the State is now co-operating with the general government for its improvement. Such bodies are usually known as "Ports," as the Port of Portland, Port of Astoria, Port of Coos Bay, etc. The personnel of a body charged with the affairs of a "Port" consist of commissioners, elective or appointive as the case may be, and generally five or more members constitute the commission.

The Port of Portland was the first organization of its kind in Oregon. From February 1, 1891, to June 30, 1912, it expended in river and harbor improvements on the Columbia and Willamette rivers, between Portland and Astoria, the sum of $4,064,421.86. This money furnished dredges and other equipment, steamers, dry docks, interest on bonds, etc. The example of Portland has been followed by nearly every community in the State suitably located. The Port of Portland operates a dry dock, and has charge of the pilotage and towage on the Columbia and Willamette rivers as far as Portland and at the mouth of the Columbia River. In addition to this work the question of securing public terminals either by municipalities or by the State, a matter now generally recognized as important, has received attention.

The City of Portland has created a Public Docks Commission with power to issue $2,500,000 in bonds to commence the construction of modern docks and terminal facilities on both sides of the Willamette River. This amount is but a small portion of what will be necessary to carry out accepted plans. Other cities on navigable waters, such as Astoria and Marshfield, as well as interior cities on navigable rivers, have like projects

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under way. It is to be regretted that the importance of securing public terminals was not sooner recognized, but there can now be no doubt but that their necessity is understood. The acquisition and development of public terminals will doubtless be rapid.

To this Commission the necessity for securing the greatest possible use of our waterways seems to be of the utmost importance. In the general concern for improvements of waterways, for use as transportation agencies, other equally valuable uses have been overlooked and neglected. Owing to the character of our rivers, climatic conditions, and limited coal supply, in certain sections, this subject is of peculiar concern to Oregon. A committee, of which the Chairman of this Commission was also chairman, was appointed by the National Rivers and Harbors Congress to report on the subject of co-operation and co-ordination of government agencies having in charge various natural resources. We take excerpts from that report, as it embodies the views of this Commission.

I.

There are a number of governmental scientific agencies having in charge and under their control various national public resources. Generally speaking these agencies are fairly equipped to carry on their work and are in charge of competent men. The Engineer Corps of the Army, the Reclamation Service, the Geological Survey, the Forest Service, and other branches of the Agricultural and Interior Departments are illustrative. These agencies in the public interest should be in the closest co-operation and co-ordination, but such is not the case.

II.

The various departments are frequently dealing with the same agency or public resource, in its application to some particular service, giving but little, if any, consideration to co-ordination with other available services or uses to which such agency or public resource might be put. This is not the fault of the departments, but the failure of Congress to make provisions therefor. It is the opinion of the committee that the best results can only be secured, and the public interest promoted, through co-operation and unity of purpose and action.

III.

There is scarcely a river worthy of improvement for navigation but what has other beneficial uses to which it could be put, and other conditions which require treatment and consideration, all of which bear directly upon the navigability of such river, or add to the productiveness of adjacent territory or further its development. We refer to forest protection, prevention of damage from flood, soil erosion, drainage, irrigation, and water power development. It would therefore seem in the public interest that the improvement of a waterway for navigation could well contemplate the conservation and utilization of such manifestly beneficial uses at the same time.

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IV.

It is generally conceded that the improvement of rivers for navigation is a necessity and that this improvement should be based on a comprehensive scheme under some general plan of related projects, the work to be carried on continuously until completed.

V.

At the present time there are a large number of organizations, and vast numbers of people, interested in various phases of water use and development which it would seem could be united in a common purpose for a common cause. Transportation is a tax that touches all, and producer and consumer alike are interested in securing cheap and efficient means of transportation. Therefore those who create tonnage are directly interested in its reaching the markets at the lowest possible cost, and those who propose to engage in water transportation are certainly interested in the development of tonnage tributary to the waterways.

The recommendations of the committee, which recommendations we heartily endorse, were as follows:

"That this organization should advocate a comprehensive scheme of waterway development of related projects;

"That this scheme should involve and consider all the beneficial uses which the waterway may serve or to which it may be put;

"That the work of the various scientific services of the government should be co-ordinated;

"That the several states and the nation should co-operate and act in harmony in all matters of common interest; and

"That funds should be provided so that work on all approved projects can be carried continuously to completion."

The slightest consideration of the application of the principle contended for as applied to the Columbia and Snake rivers, and also the Willamette River, will show its enormous possibilities, and tremendous consequences to the people of the entire Northwest. We presented this matter in our report of November 15, 1908, and as the conclusions reached then still embody our views, we quote therefrom, commencing at page 13:

"The value of this stream system for navigation, irrigation and power cannot be estimated. It staggers the immagination to even contemplate it.

"The value of coal as an agency for the creation of heat and power is recognized by everyone, and we could within certain limits measure its value to this section of country if it were found at convenient intervals and generally distributed. This, however, is not the case, but little coal being found in much of the section under review. Yet, substantially from the souce of these rivers almost to their mouths their currents are potentially a giant dynamo, needing but intelligent development to furnish a never-failing source of limitless power. Indeed it is hard to see any good reason why, when the government is spending millions to control these rivers for transportation uses at the site of some great power producing point like Celilo or the Cascades, its adaptability for this purpose should not be considered and utilized at the same time, and the improvement not only serve a two-fold purpose, but also create a source

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of enormous income which could be used for further improvement. It has been estimated that between Celilo and Big Eddy there could be developed an average minimum of 466,000 horsepower, and at the Cascades 150,000 horsepower.

"Much of the country through which the rivers flow east of the Cascade Mountains is arid. This does not mean worthless or useless, for no place under heaven rewards the husbandmen to a greater extent than do these arid lands when the water which flows past them is turned upon the soil and put to another of its great uses. Thus we have allied a trinity of uses—transportation, power, and irrigation—all related, all easily co-ordinated, and the three combined forming the most powerful stimulus to development on the highest possible lines. Rich soil, easy irrigation, with assured crops and those of high values, low transportation charges and cheap and abundant power should in time create not only a section great in production, large in population, but what is of more importance, a people of a high degree of intelligence."

In that same report we closed the section on water transportation with the following conclusion, which time and experience has but served to confirm:

"The improvement of the waterways and harbors of Oregon and its sister states is essential to their full development. Realizing this, it is not difficult to see why the people of the Northwest take such an active interest in this subject.

"The power of the Columbia was such that it rent asunder the great Cascade Range and created a water grade, *and the only water grade*, from the great producing section east of those mountains to the sea. Down this grade the commerce of that section will surely flow, and through the mouth of that river it will reach the sea and radiate to the furthermost parts of the earth. Properly improved, these rivers will operate not only as natural rate regulators, but will furnish additional facilities for transporting the products of the country. In addition to this, under the guidance of the skillful engineer they will water our lands, and furnish us power, and in so doing, instead of being destructive, they will be creative agencies, doing more than all other agencies to develop the country and add to the happiness and prosperity of our people. While doing all this and adding to our present enjoyment and well being, they will also, for the future and forever, be a source of income which will grow and expand with use, thus enabling future generations to enjoy what it is hoped the present generation will conserve and preserve as a sacred trust."

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FISH AND GAME.

GAME LAWS AND THEIR ADMINISTRATION.

The enforcement of laws pertaining to game, game fish and commercial fish, as well as the management of matters pertaining to these subjects, is within the control of a non-partisan Board of five members. This Board, appointed by the Governor, serves practically without compensation. The law creating the Board was enacted by the 1911 session of the Legislature. Prior to the enactment of this law protection of game was delegated to a State Game Warden, appointed by and responsible to the Governor of the State. Matters relating to commercial fish and fishing were under the direction of a Master Fish Warden, holding his appointment under a Board of Fish Commissioners, consisting, *ex-officio*, of the Governor, Secretary of State and the State Treasurer. The enforcement of laws pertaining to game fishes was assumed to be jointly within the jurisdiction of the State Game Warden and Master Fish Warden with the result that the laws were laxly administered.

The 1905 session of the Legislature enacted a hunters' license law, and the session of 1909 added to this an anglers' license law. The accumulation of fees accruing formed a considerable fund, a large part of which was in the State Treasury at the time the 1911 act went into effect. This was largely due to failure on the part of the Legislature to make sufficient provisions looking to expenditures for artificial propagation.

The condition of affairs prior to 1911 had created a very general feeling of dissatisfaction throughout the State, and the laws relating to game and game fish protection were not only disregarded but in the main were held in contempt. Supporters of the new law foresaw complete extermination of Oregon's game and game fish unless conditions were speedily remedied. The 1911 law giving wide latitude to a newly created State Board of Fish and Game Commissioners was the result. The law creating the Board requires that four of its members shall be selected by the Governor, that no more than two of these shall belong to the same political party, and that two of them shall be residents of that part of the State lying east of the Cascade Mountains. The fifth member is selected by the other four.

The Board has for the past two years taken up its work in a systematic and business-like manner. Its members have visited most of the State properties under its control. Formal sessions are regularly held for the transaction of business.

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PROPAGATION OF FISH.

Few changes have been made in the policy of the department toward the commercial fishing interests of the State, since most of the regulations which bear on this matter are governed by statute and, therefore, not subject to any change by order of the Board. Increased energy has, however, been brought to bear on the work of artificial propagation of commercial fish. This work is largely directed toward increasing the stock of the several native species of salmon in the waters of the State. All of the native species are propagated, but chief effort is directed toward keeping up the stock of chinook salmon because of the fact that this species is considered the most valuable of our native salmon. The Board has consistently urged the wisdom of holding and nursing as great a number of young fish as possible to an age of from five to eight months before liberating them. When once in free waters these fish must shift for themselves and on account of numerous enemies very small fish stand a poor chance of ever reaching maturity. With the object of creating better facilities for nursing young fish to a suitable age for liberation, the several principal hatching stations are now being improved by the construction of extensive nursing and rearing ponds. This work is under way at the Central Hatchery at Bonneville and at the Clatsop County Station on the Clatskanie River. Similar construction is well under way at the station on the McKenzie River, as well as at the one on the Wallowa River. It is the intention to similarly equip all stations in the State as fast as satisfactory plans can be produced. In addition to the work of constructing rearing ponds the facilities for storage and preparation of fish food are being improved as fast as means will permit.

From spawn taken during the Fall of 1911 and Winter of 1912 results obtained at the different hatcheries are shown in the following tabulated statement:

Station	Sockeye	Chinooks	Silversides	Steelheads	Total
Bonneville	1,967,825	10,599,490	589,605	*1,225,745	14,372,665
Clatskanie	.....	2,522,500	377,655	.....	2,900,155
McKenzie	.....	75,000	.....	.....	75,000
Tillamook	.....	646,300	1,578,131	*831,000	3,055,431
Yaquina	.....	148,992	1,554,602	7,145	1,710,739
Alsea	.....	287,645	997,455	.....	1,285,100
Siuslaw	.....	715,758	504,429	72,097	1,292,284
Umpqua	.....	1,258,747	.....	.....	1,258,747
South Coos	.....	1,767,170	2,317,370	.....	4,084,540
Coquille	.....	221,740	1,672,850	.....	1,894,590
Totals	1,967,825	18,238,342	9,592,097	2,135,987	31,924,251

*Distributed as game fish.

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HATCHERY SITE FOR GAME FISH SOUGHT.

Practically nothing had been done in the State toward the artificial propagation of native or exotic game fishes up to the time of the creation of the State Board of Fish and Game Commissioners. The judicious expenditure of funds provided through the payment of anglers' licenses for the purpose of protecting and propagating game fishes was held by the Commission to be one of its chief duties. A location where as large a supply as possible of parent or brood fish of game species could be used for propagating purposes was consequently selected. Negotiations have been under way for more than a year to acquire for the State the necessary ground and water rights to enable a central game fish egg taking and hatching station to be established on Spring Creek, Klamath County. The land selected is within the boundaries of the Klamath Indian Reservation, and up to the present time the Board has not been successful in its efforts to procure the necessary site. Lacking a plant where wild fish could be captured in great numbers for spawning, and not deeming it wise to start the building of an extensive station for the maintenance of a large school of brood fish as long as there seemed reasonable prospect of obtaining the site at Spring Creek, the State Board has been forced to the makeshift of getting eggs for propagation work wherever they could be obtained. This has been done either by purchase from game fish stations in other States or by capturing the wild fish in limited numbers. By these methods game fish have been produced as shown by the following tabulated statement:

Station	Steelhead	Rainbow	Eastern brook	Black spotted	Total
Tillamook	3,767,000			4,150	3,771,150
Yaquina	14,000			131,100	145,100
Olive Lake		243,500			243,500
Strawberry Lake		32,500		202,000	234,500
Salmon River	498,000				498,000
McKenzie		195,465			195,465
U. S. Bureau		370,770			370,770
Colorado		103,600			103,600
Rhode Island			1,000,000		1,000,000
Yellowstone Park				625,000	625,000
Montana		* 806,000			806,000
Totals	4,274,000	1,251,835	1,000,000	962,250	7,468,085

*Eggs lost enroute to Bonneville. No fry resulting therefrom.

The liberation of game fish fry into the waters of the State has progressed during the Summer of 1912. By the end of the season all of the fry reared will have been released in as equitable a manner as possible consistent with facilities.

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PROTECTION OF FISH.

Following the example of its predecessors, the Board has directed the seining out of the sloughs and empounded leads of water along the lower Willamette and Columbia Rivers to clear them of useful fish before these places dry up, with the lowering of the levels of the main streams, thus saving from waste large numbers of valuable fish that would otherwise die. The species thus conserved have been mostly bass, croppies and sun fish; all exotic fish but nevertheless abundant in Oregon waters through planting. The fish thus saved from destruction have been released in free waters and in ponds and reservoirs well adapted to their use but not previously inhabited by useful fish.

An active campaign has been instituted in the State for the enforcement of the law requiring that all obstructions in streams inhabited by migratory fish be provided with efficient fishways, to enable the fish to pass freely up and down stream. Conditions in this regard are far from satisfactory but substantial improvement has been brought about and it is hoped that in a short time every dam or natural fall will be provided with a suitable fishway.

Consideration has been and will continue to be given to the matter of irrigation ditches, canals, and other forms of diverted stream channels, in their relation to fish life and fishing interests. A considerable waste of valuable fish is each year caused by both mature fish and young fry following these artificial channels and being finally spread out on the land. The law requires screening of the channels of all diversions of natural streams to prevent the entrance of fish. It is found, however, that in practice any screen with meshes fine enough to turn small fry will soon clog and stop the flow of water into a ditch. The result is obvious. Many inventions have been produced to screen ditches, but the State Board has found none of these in every way satisfactory. Three different styles of automatic screens have been approved by the Board, but none have been formally adopted and their use made compulsory.

PROTECTION AND BREEDING OF GAME BIRDS.

The 1911 session of the legislature enacted a law which prohibits for two years the shooting of introduced pheasants. By this means it is thought the birds will so increase that an open season can again be declared.

In order to help the natural breeding of game birds, particularly several species of introduced pheasants, the State

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Board has considered breeding in captivity and the subsequent liberation of large numbers of game birds. In the Fall of 1911, a contract was entered into for the leasing by the State of a game farm in Benton County. This farm is managed under the direction of the State Game Warden and the State Board. This game breeding plant is now in full operation and will turn out the season of 1911, 2,000 Chinese pheasants, 200 Reves pheasants, 150 Golden pheasants, and 60 Silver pheasants. Besides the work on the different species indicated, Experimental work in being conducted on native birds and other foreign birds with a view to ascertaining their ability to breed in captivity.

The plans of the Board in connection with the liberation of game birds reared on the farm is to plant them in localities where they are now least abundant and where they can be assured of as good protection as possible against unlawful destruction. For this purpose tracts are being secured in numerous places and are being designated, marked and posted as game refuges. The game on these tracts will be carefully protected with the idea that through increase it will gradually spread beyond the boundaries of the protected areas and thereby stock the surrounding country. Thirty-six contracts for the establishment of game refuge tracts have been made throughout the State, covering a total of 12,402 acres. Six other contracts are under consideration.

The Deputy Warden service of the State has been entirely reorganized. The corps of deputies is divided into three classes, District Deputies, Regular Deputies, and Special Deputies. The first class are composed of the most active and efficient men and they are charged, in addition to the regular duties of Deputy Game Wardens, with supervision and, in some measure, control over the other Deputies within prescribed districts. The Special Deputies are volunteer citizens, who are commisioned and supplied with a badge of authority, but are paid no regular salary though expense money is furnished in special cases.

BIG GAME PROTECTION.

The protection of the native "big game" is under the immediate care of the corps of Deputy Game Wardens. No effort is being made by the Board to breed game animals in captivity. One experiment in conjunction with the Bureau of Biological Survey of the Federal Government, is being conducted with a view to determining the practicability of transplanting wild wapiti or elk from one part of the nation to another.

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During the past winter a herd of fifteen elk was accepted from the Federal authorities at St. Anthony, Idaho. The elk were taken from the Jackson's Hole region in Wyoming, and were transported to the Northeastern part of the State and placed in an enclosed area within a National Forest, the use of the enclosure being donated for this purpose by the Forest Service. It is still too early to prophesy results in this experiment, but a fair percentage of the animals survived the long journey by rail, wagon and sled, and are now confined within a 2,500 acre pasture.

Oregon's stock of "big game" animals has rapidly decreased with an increasing population. Deer are more plentiful today in several Eastern States than in the mountainous districts of Oregon. It is believed that this condition is due to a number of causes, chief among which are lax enforcement of poorly framed laws, and the raids of predatory animals. It is believed that if illegal killing, particularly of does, can be stopped, and wolves, cougars and wild cats exterminated, deer will naturally increase, even with a reasonable open season for hunting. To remedy the first cause the State Game Warden is making rapid progress through strict enforcement of the law. The State is, however, so large, and the sentiment of the people towards game protection has become so perverted, that even with the strenuous efforts of the past two years far from a satisfactory state of affairs exists, though progress can be noted. A campaign of education in an effort to create a sentiment favorable to game and bird protection, and in opposition to what seems to be the prevailing sentiment amongst the populace, is being carried on and will doubtless bear fruit.

For the elimination of the second cause action of the next session of the legislature is looked to. All authorities agree that predatory animals, particularly cougars and wolves, kill annually more deer in Oregon than hunters. It is strongly recommended that the State bounty on these animals be made sufficiently large to induce systematic hunting of them to a point where they will become rare, if not extinct. This will be a decided economy in the end.

Recommendations.

One of the duties imposed upon the State Board of Fish and Game Commissioners by the Governor is the recommendation of revisions and improvements of the State laws affecting fish and game. This body is now actively engaged in the formulation of an entirely new code of fish and game laws,

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which it will present for the consideration of the 1913 session of the legislature with a view to its substitution for all existing laws now in force in the State. The suggestions of the Board should receive most careful consideration.

Members of the State Board receive only nominal remuneration for their services. Their salaries are fixed at five dollars per day while actually in session, with a proviso that the annual compensation of any one member shall not exceed one hundred dollars. Those who have undertaken this work can not, therefore, be charged with selfish motives. They are actuated solely by a desire to improve conditions in the State. The commercial fishing interests of the State is third in magnitude as compared with other industries. Faulty laws and inefficient enforcement of them has decreased this industry and threatens it with extinction. To check the downward tendency in this industry is one of the great objects of the State Board and of this Commission. By stimulating artificial propagation and improving the supply of valuable food fishes naturally inhabiting the waters of the State, it is believed much can be accomplished. Nor are the benefits to be derived from having streams well stocked with game fish and the mountain districts with game animals overlooked.

This Commission recommends an active campaign to secure greater Federal aid in maintaining and increasing our supply of commercial fish, to the end that a great industry may continue. It recommends more liberal State assistance for the same purpose. It recommends the protection of game and game fish, in the firm belief that such action will return to the State large profit for all funds expended in this connection; and it further recommends revision of our present laws, along lines which will make protection and propagation of both fish and game possible.

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ACTIVITIES OF THE COMMISSION.

STIMULATING INTEREST IN DIVERSIFIED FARMING, SEMI-ARID SECTIONS.

It would be generally conceded that there is not only room for improvement in farm life but also in farm methods. It is the opinion of the Commission that, if modern methods of agriculture and horticulture were generally practiced, and if good roads existed with which to get about, farm life would soon take on a new aspect and become more attractive. We believe the solution lies largely with the farmer. He has the problem largely in his own hands, and has the power to enforce his views. Oregon is primarily an agricultural state and anything that will add to its productiveness is of unquestioned importance to all. A very considerable portion of the State is semi-arid, and here dry farming methods must prevail. In certain of these sections, if not all, wheat is the main product on which the farmers rely. Diversity of crops is almost unknown. The result is what might be expected, large holdings, uncertain crops, diminishing population, and poor financial conditions. To aid in bettering these conditions, to encourage the use of better methods, and to secure diversity of crops, the Commission undertook to lead in an effort to see what could be accomplished in three of the semi-arid counties of this State, Sherman, Gilliam, and Morrow. The work strictly speaking possibly belongs to the field covered by the State Agricultural College, but this institution was without funds to carry on the work. The Commission therefore, in connection with the College and the Oregon Development League undertook the work. Great interest was shown by the people in the counties referred to, and it led to the formation of the Tri-County Development League. Premiums to the amount of $390 for each county, or $1170 in all, were offered for the following farm productions:

For the best two acres of field peas grown on typical wheat land and not sub-irrigated bottom land.

Best one-tenth acre of corn grown on typical wheat land by a boy under 18 years of age.

Best one-tenth acre of milo maize or kaffir corn grown on typical wheat land by a boy under 18 years of age.

Best one acre of alfalfa grown on typical wheat land.

Best five hogs fattened upon peas by the system known as "hogging off."

For the best kept flock of not less than fifty hens for nine months. Record keeping and economy of production considered.

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In addition special prizes were offered as follows:

For the best five acres of either Spring or Fall sown wheat, to be grown upon typical wheat land, precipitation of locality in which the wheat is grown to be considered in awarding the prizes:

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Gilliam County.—Double Cut Disc Harrow, donated by the Oregon Moline Plow Co., Portland, Oregon.

Morrow County.—1st Prize—No. 1 New Superior Fanning Mill and Bagger, donated by the Foott-Titus Machinery House, Portland, Oregon. 2d Prize—Deep Well Pump, donated by the Reierson Machinery Co., Portland, Oregon. 3d Prize—$25 in cash by Beall & Co., Portland, Oregon.

Sherman County.—Empire Junior (16) Single Disc Drill, donated by Mitchell, Lewis & Staver, Portland, Oregon.

For Tri-County Fair to be held at Condon, October, 1912:

A scholarship in the Oregon Agricultural College, offered by the Portland Union Stock Yards Company, for the best sow pig under six months old, shown by a boy or girl under 18 years of age.

Cash prizes of $20, $10, $5, $3 and $2 for first, second, third, fourth, and fifth best 12 ears of Field Corn grown on upland, offered by the Oregon-Washington Railroad & Navigation Co., the prize-winning ears to become the property of the company for exhibition purposes.

A silver cup, offered by R. T. Cox, of Portland, for the best sow and litter of pigs of any breed.

A silver cup, offered by W. F. Burrell, of Portland, for the best Duroc Jersey Boar Pig under six months old.

A silver cup, offered by the Plateau Farm Company, for the best bushel of Forty-fold Wheat.

A silver cup, offered by Balfour, Guthrie & Co., of Portland, for the best bushel of Bluestem Wheat.

A silver cup, offered by J. N. Teal, of Portland, for the best bushel of potatoes grown on upland.

A silver cup, offered by Allen & Lewis, of Portland, for the person or family making the largest number of exhibits of merit.

A silver vase, offered by Mrs. D. P. Thompson, of Portland, for the best loaf of bread made by a girl under 15 years of age.

A silver vase, offered by Miss Genevieve Thompson, of Portland, for the best display of preserved fruit put up by a girl under 15 years of age.

A silver vase, offered by Mrs. J. N. Teal, of Portland, for the best pound-cake made by a girl under 15 years of age.

A silver vase, offered by A. & C. Feldenheimer, of Portland, for the best exhibit of butter.

Merchandise to the value of $10, offered by Closset & Devers, of Portland, for the best trio of chickens of any breed.

Merchandise to the value of $10, offered by Closset & Devers, of Portland, for the best trio of turkeys.

We have also maintained in these counties, during the year, a skilled Agricultural Advisor, who has been continually traveling throughout the counties visiting farms, explaining new methods, and generally carrying the gospel of diversified

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farming and improved farm methods direct to the farms and into the homes of the people.

The money to carry on this work has all been subscribed by public-spirited citizens of Portland. It will be noted the premiums and prizes were offered so as to induce the young people to compete, as it was felt that, if they could be interested, the success of the undertaking would be assured. In October of this year a Tri-County Fair will be held at Condon and we venture to predict that whoever visits this fair will be surprised at the diversity and quality of the productions which will be shown.

We are entirely convinced that it is to the interest of this State that experimental farms and experienced agricultural advisors be maintained in nearly every county in the State. The benefits that will follow this course are incalculable. It will mean the breaking up of large bodies of land, more intelligent farming, reasonable recompense for the farmer, happier homes, better education, and increased population. It is but a truism to say we all depend upon the soil. So long as the money is intelligently expended the State can afford to appropriate any reasonable sum in advancing its agricultural possibilities. The three counties referred to comprise an area of 4,103 square miles, and maintain a population of about 12,300 people. This section is fairly illustrative of thousands of square miles in other sections of the State, and where the population is even less. The soil is rich, the climate pleasant, but the rain-fall over much of the area is light. In these sections scientific farming knowledge can be applied with splendid results. There is no doubt as to the ultimate success under intelligent directions. The State has no higher function than the advancement in every reasonable way of the prosperity and happiness of its people, and a great agricultural State such as Oregon can not afford to forego the opportunity offered.

WEST UMATILLA PROJECT.

Immediately adjoining the lands under the Umatilla project, in Umatilla County, Oregon (a project under the control of the United States Reclamation Service), there is a vast body of arid land lying west of the Umatilla River and south of the Columbia River. Logically this section is a part of the Umatilla project and should have been so treated originally. About thirty thousand acres are covered by the West Umatilla project, and at present this land is lying substantially unused and unusable. To irrigate this land the cost per acre will

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be reasonable. A very large portion of it is public lands. Another very large portion, owned by the Northern Pacific Railroad Company, through the offer of that company, is in a nature public. The climate is pleasant, transportation facilities adequate, and the best of markets are within easy reach.

For a long period this project seemed doomed to permanent abandonment for it was feared that so long a period might elapse before the government would act that private rights would intervene to an extent that would make it hardly feasible for the government to undertake the reclamation. However, an active effort was made to secure the adoption of the project and funds for its construction. The matter was taken up with the Secretary of the Interior about October, 1911, by the Governor, our Senators, Representatives, and this Commission. The Chamber of Commerce and other organizations took a sympathetic and active interest, with the result that the project was finally approved by the President. Preliminary work is now substantially completed and it is thought that before long active construction work will commence.

The benefit to the State and the Northwest generally of this project cannot be over-estimated. It is not only that a vast body of land will be supplied with water and provide homes for many families, but what is even more important is the fact that immediately adjacent to it lies a still larger body of excellent land, the utilizing of which through irrigation will surely be induced, not only by the completion of the West Umatilla project, but by its commencement.

Under all the circumstances we feel that the people of this State are to be congratulated on the outcome of the effort made in their behalf.

CENTRAL OREGON.

This Commission has taken up with the Department of the Interior the possibility of securing cooperation between the State and Nation looking to the fullest development of the irrigation and water power possibilities of central Oregon. This can only be secured through constructive and comprehensive action and cooperation. The amount of land that can be made available for use, and the water power that can be developed under a proper scheme, is great. It is the purpose of the Commission to bring about the development of unused resources of inestimable value in such a manner that the development of each unit can be co-ordinated with a general comprehensive plan. When one considers the general benefits

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that would result from the creation of hundreds of thousands of horse power in Central Oregon, within reasonable reach of a very large area of country, and the enormous area of land now non-productive, which can be irrigated under some general plan and through cooperation between the State and Nation in harmonious relation with private enterprises, the importance to the entire State of the plan proposed must be apparent to all.

NATIONAL MATTERS.

One of the most important functions of a State Commission is to keep in touch with existing and proposed State and

MIDDLE FALLS OF McKENZIE RIVER—60-FOOT DROP

National legislation respecting and affecting the public resources of the State.

Laws are now pending in Congress covering the leasing of public lands and lands within the National Forests. The State is particularly and directly interested in laws affecting the water powers within National Forests, and is also interested in those affecting other rights. The Commission has endeavored to keep in touch with all such laws and, so far as possible, those affected have been advised of their purpose. We have from time to time taken such action affecting these laws as we deemed to be in the public interest. In connection with many public resources it is extremely difficult to draw

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the line between the State and National sovereignty. Indeed there is a constantly recurring "twilight" zone over which the authority is obscure and often doubtful. Under any circumstances it is clear that the closest cooperation should exist at all times between the State and the Nation in the preservation and conservation of the public resources, and every effort should be made to work in harmony and coordination. With the increased tendency of both the State and Nation to broaden and widen their activities in connection with care and disposition of public resources, it is clear that there should be some State body whose duty it is to keep in touch with National legislation, to the end that the public as well as the officials of the State may be kept properly advised as to all subjects under consideration and their proposed treatment.

FINANCIAL.

The legislature of 1909 appropriated one thousand dollars for the use of this Commission. The legislature of 1911 made no appropriation. By the closest economy and by performing the greater part of the clerical work themselves, or having it performed by others at their expense, the members of the Commission have been able to keep such expenditures within the appropriation not only for the two-year period but for a four-year period. Taking into consideration the duties imposed upon it by law, it is perfectly obvious that the sum mentioned is insufficient to provide for even the ordinary clerical expenses of the Commission. The work of the Commission simply could not have been carried on, had it not been for the voluntary contributions of public spirited citizens. The members of the Commission desire no compensation, but, in view of the services they are glad to render, the Commission should at least have sufficient funds to enable them to meet at appropriate intervals and to carry on their work without relying on public subscriptions. The states of New York and California, realizing the importance of the preservation, conservation and use of the States' resources, have created State conservation commissions and have imposed upon them important duties. The states have provided their commissions with sufficient funds so that in carrying on a work for the benefit of the people of the State necessary information can be gathered and this information made available. In New York the commission is among the most important of its public bodies and is directly charged with the care of the State's public resources. A higher duty than that of conserving and putting to wise use in the interest of all

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the people our public resources can hardly be conceived. The practices of the past certainly carry their own lessons, and we are in many ways paying the penalty for our neglect in this respect. If we continue the same course and pursue the same methods in the future, we do so with our eyes wide open.

The State water code and forest law are examples of the character of legislation sought and advised by this Commission, and furnish in themselves a sufficient justification for its proper maintenance. We have already referred to the necessity of a body of this kind to cooperate with the Nation in many matters which will be difficult to handle in any other way. In view of the existing conditions in respect to public resources, the methods which are gradually being adopted in conserving and disposing of them, the trend of legislation and public opinion generally upon the subject, it is apparent that cooperation between State and Nation is absolutely essential if we are ever to reach the full measure of our development or secure the best results in the disposition, care and use of our public resources.

Respectfully submitted,
OREGON CONSERVATION COMMISSION,
Joseph N. Teal, Chairman.

Members:
F. G. Young, Secretary,
William Pollman,
Mrs. Josephine Hirsch,
C. B. Watson,
B. F. Irvine,
Fred F. Henshaw.

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UNDEVELOPED WATER POWER

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APPENDIX

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UTILIZATION OF CHEAP WATER POWER IN NORWAY, SWEDEN, AND OTHER COUNTRIES.

The progress in water power and electrical development is advancing at such rapid pace that but few text books are published containing the latest information. Technical publications are accessible to but few, and the information there presented is usually in such detail as to be of little value to the layman.

We, therefore, deem it advisable to publish the latest information from Norway and Sweden, as found in the "Daily Consular and Trade Reports" of the U. S. Department of Commerce and Labor. It is believed to be accurate, is in simple language, and has been prepared by experts.

This information should afford a basis for estimating the value to the public in adopting at this time, some definite policy which will eventually result in putting to beneficial use, the undeveloped water powers of Oregon.

CHEMICAL INDUSTRIES OF NORWAY.

(From Consul Thomas H. Norton, Chemnitz, on special detail, Nov. 20, 1911.)

"Numerous factors have combined to retard the industrial progress of Norway. The climate is severe, coal is lacking, the mineral deposits are not easily accessible, the area of tillable land is very limited, and the industrial education of the people is not advanced.

"Less than 3 per cent of the land is under cultivation, about 25 per cent is covered by forests, and the remainder consists essentially of moors, mountain pastures, lakes and marshes. The conditions of life have been comparatively hard and emigration extensive. Exports to other countries have been limited chiefly to timber and the products of the extensive fisheries.

"There is, however, now a marked change for the better. Norway bids fair to develop into an industrial state of considerable importance, and the chemical industries are the ones coming most prominently to the fore in the movement. The first step forward was taken in the development of the *wood-pulp industry*. The second, and most important for Norway's future, was the utilization of the country's *magnificent water power* for the establishment of electro-technical and, more especially, of electrochemical industries on a scale *impossible in any other European land.*

GROWTH OF THE CHEMICAL INDUSTRY—WAGES.

"The general movement forward in the manufacturing industries of the Kingdom and more specifically in the various branches of applied chemistry may be measured by the growth during the decade 1897-1908. It should be stated, in this connection, however, that a very noticeable increase in the establishment of new factories, mills, etc., began in 1890. It reached its maximum in 1899. There was a decline in the rate until 1904, when a new period of activity set in, and has continued uninterruptedly until the present time.

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"During the decade ending 1908, there was in Norwegian industry an increase of 45 per cent in the number of "years of work," i. e., the total number of days of work in a year divided by 300. This increase is five times greater than the increase of population. During the same period there was an increase of 159 per cent in chemical manufacturing branches. There was an absolute increase of $21,440,000 in the amount of wages paid to operatives, representing an advance of 82 per cent. This advance in chemical industries amounted to 333 per cent.

"The average annual wage for all operatives, in all industries, was $210.38 in 1897, in 1908, $264.52 an increase of 26 per cent. In chemical industries the average annual wage advanced 67 per cent during the period. The average daily wage of adult operatives in all industries was $0.82 in 1900, and $0.92 in 1908.

"In 1897 there was, on an average, 1½ horsepower of motive force (equal to the work of 25 men) employed per operative in Norwegian factories. In 1908 it had increased to 2½ horsepower. The average establishment employed 45 horsepower in 1897 and 76 in 1908."

MANUFACTURE OF OXALIC ACID.

"One large lumber firm at Frederiksstad carries on very successfully the manufacture of oxalic acid. It is made by fusing sawdust with a mixture of the caustic alkalies. Sodium oxalate is separated by crystallization from the solution of the fused product and transformed into calcium oxalate by treatment with milk of lime. The pure acid is secured from the calcium salt by the usual treatment with sulphuric acid. The export of oxalic acid, amounting to $37,000 in 1910, goes chiefly to the United States. The firm in question manufactures also such oxalates as are demanded in commerce."

MANUFACTURE OF CALCIUM CARBIDE—CALCIUM CYANAMIDE.

"The manufacture of calcium carbide was the pioneer electrical industry in Norway, and considerable English capital has been invested in this branch. A French company operates one plant at Hafslund. The Kellmer Partington Paper Pulp Co. at Borregaard is a good example of foreign investment in Norway. The company utilizes 24,000 horsepower, and employs 3,000 workmen in its carbide factory, ferrosilicon works, and large pulp mill. It is the largest industrial establishment in the Kingdom. The Albion Products Company at Notodden, and the Alby United Carbide factories at Odda, are two other large English undertakings. At Trondhjem, the Meraker Carbide & Smelting Works have added to their extensive works plants for producing forrochrome and ferrotitanium. The seven carbide works employ a total of 60,000 horsepower. They are all located on the coast or on navigable rivers, and manufacture almost exclusively for exportation. In 1910 they shipped 50,579 metric tons at an average price of $32.16 per ton. The average daily yield per horsepower is roughly estimated at 2⅓ kilos, or 843 kilos in the year. In German factories, the yield ranges from 3 to 5 kilos, as compared with a theoretical maximum of 8 kilos. The equipment of the carbide factories in Norway is essentially the same as that of the American factories.

"An English company, the Northwestern Cyanamide Company has built large works at Odda, on the Hardanger Fjord, and established on a successful basis the manufacture from atmospheric nitrogen of calcium cyanamide, which is competing with Norwegian calcium nitrate for

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recognition as the most economic form in which the air can furnish nitrogenous compounds for the needs of agriculture. The firm shipped 752 metric tons in 1909 and 4,281 tons in 1910. The price is $42.88 per metric ton. The industry is evidently on a firm footing, and finds a market for its products, as do the similar works in Germany."

AIR NITRATES—SODIUM.

"At Notodden, in 1905, the first factory for manufacturing nitric acid directly from the elementary gases of the atmosphere was erected. In an enlarged form it now gives occupation to 500 workmen, and is daily demonstrating the remarkable possibilities of this new factor in chemical industry and in economic evolution. The factory furnishes all the nitrates required by Norway in agriculture and the arts, and is shipping constantly increasing quantities to foreign countries. The exports for two years were as follows: 1909—calcium nitrate, 9,422 tons; sodium nitrite, 3,200 tons; sodium nitrate, 1,074 tons.

"During 1911 the manufacture of ammonium nitrate for use in making explosives has been introduced upon a large scale, as it is profitable at present prices. Ammonia is imported from England, and after conversion into the nitrate is shipped back. A much larger factory is nearing completion at Saaheim and will be put in active operation before the close of 1911.

"A single factory at Vadheim, on the west cost, is manufacturing sodium very successfully. The export in 1909 was 179 tons. The price is $0.536 per kilo, or $0.243 per pound. The process employed is that of the direct electrolysis of fused anhydrous caustic soda. Fusion vessels and cathode are of iron, and the anode is of nickel iron. The success of the operation depends largely upon the pains taken to keep the temperature of the bath within the narrow limits of 310 to 330 degrees C. and the rapid removal from the cathode of the liberated metal. There is an increasing demand for sodium for use in making sodium cyanide, sodium amide, and especially sodium peroxide."

PRODUCTION OF ALUMINUM AND FERROSILICON.

"One large factory at Christianssand is devoted to the electrolytic production of aluminum. The process is practically identical with that employed in the large American works. The export of the metal was 486 metric tons in 1909 and 1,019 tons in 1910. This is equivalent to one-ninth of the annual American production. The Norwegian aluminium is sold at $0.43 per kilo. A considerable amount is employed in equipping the air-nitrate works, as the large conduits for acid gases and the piping for nitric acid are all made from this metal.

"The demand for ferrosilicon, so indispensable in the modern metallurgy of iron, is rapidly growing, as shown by the exports from both Norway and Sweden to other countries. In 1909 Norway shipped 2,645 metric tons abroad; in 1910 the export reached 5,121 tons. Much of the output is made in the electric furnaces at Borregaard."

DECREASED OUTPUT OF NICKEL ELECTROLYTIC REFINING.

"Norway possesses extensive deposits of nickel ores, much of it containing as high as 2 per cent for the metal. In former years nickel mining was of some importance, but competition with the richer ores of Canada and the United States could not be main-

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tained, and most of the mines ceased operation. During the closing decade of the last century the annual production of nickel sank to 7 tons. Since 1900 the industry has revived, and there is an annual output now of 70 tons, nearly all of which is used in the Kingdom. In 1909 the only mine worked, that of Eije, yielded 5,770 tons of ore containing 1.1 per cent of nickel. In the smelting works 2.77 tons of matte are obtained from 100 tons of ore. This matte contains 40 per cent of nickel and 25 per cent of copper. It is refined in the new electrolytic works at Christianssand, which are equipped for an annual production of 400 tons of the metal. The production of electrolytic nickel is a much more complicated operation than are those yielding aluminum or sodium. The copper-nickel matte is used as anode in a weak acid bath. Both metals are dissolved and pure copper is deposited on the cathode. At a certain point, when the electrolyte contains in solution (by hydrogen sulphide) and then the iron is removed with the customary precipitants. From this purified and heated solution nickel is deposited electrolytically, insoluble anodes being used. The electrolytic nickel has a high degree of purity and is fairly compact. The total consumption of electricity is relatively large and the process can be employed with advantage only where the cost of the current is exceptionally low, as is the case in Norway."

ELECTRIC SMELTING.

"The success which has followed the experimental trials of the Gronwall furnace for the electric smelting of iron ores, first at Domnarfvet, in central Sweden, and later on a larger scale at Trollhattan near Gothenburg has demonstrated beyond question the economic and technical advantages of this new process. The Norsk Electrometal Co. has promptly secured patent rights for Norway, and two companies are now constructing electric iron-smelting works under their licenses. The Hardanger Electriske, of Staalwerk, is erecting two furnaces at Odda that will use 5,800 horsepower from the Tysse fall. The company controls in all 15,000 horsepower at this point. At Arendal the Arendals Fosse-Compagni is building furnaces that will utilize 6,000 horepower, and is able to increase it to 30,000.

"A somewhat different type of smelter is under construction near Notodden by the Tinfoss Hernoers Aktieselskab, which will use at first 5,000 horsepower and can increase it, if necessary, to 15,000. Unquestionably within a few months the electric manufacture of an excellent grade of iron will be established in Norway on a good working basis.

"The electric smelting industry promises much for the country. In earlier years Norway possessed a flourishing iron industry, but saw it gradually decline as the fuel became more and more expensive. The land is rich in iron deposits, most of which are too remote to permit of advantageous minning at present. The Norwegian magnetite is not rich enough to warrant its export, and it is too hard for English smelters. If exported, at all, it must usually be previously concentrated and briqueted, involving considerable expense. This magnetic iron ore, however, frequently contains sufficient lime to be self-fluxing. When adequate and cheap water power is near the mines, not only the magnetic ore, but the low-grade ores not worked at all now can easily be turned into first-class steel billets and offer a large margin of profit at present prices. It may be that Norway will rank eventally among the prominent ironproducing countries of Europe, as but little is known about the full extent of its mineral wealth especially in the northern less-accessible regions."

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ELECTRIC STEEL FURNACE.

"Active steps are also being taken to introduce the electric steel furnace. The Hardanger company is installing one requiring 800 horsepower, and other plans are on foot. The fine grade of iron obtained from an electric smelter with the use of charcoal is almost free from manganese and silicon. If brought into a mixer heated with gas, and then refined in an electric furnace, the steel produced should be of an exceptional quality.

"All of these plants and projects are dependent upon the continuance of the cheap rate for water power in Norway. In Sweden the cost per annual horsepower is apt to range above 50 crowns, or $13.40. In Norway rates vary usually between $5.40 and $10.70. There are some cases where the cost is even as low as $4.00.

"In addition to the foregoing enterprises, Norwegian capitalists are discussing the establisment of electric works for zinc smelting, for nickel smelting, and for the combined electric smelting of copper ores and the electric refining of the metal."

ELECTRIC HEATING IN NORWAY.

(From Counsul P. Emerson Taylor, Stavanger, Norway, Jan. 6, 1912.)

"The initial steps are being taken in this city for the installation of a system of electric heating. A few small firms are already heating their establishments by electricity.

"The board of directors of the city electric-light plant has made application to the city council, asking that it be given full power by the council to make all contracts with firms desiring to install electric heating and transmitting to the council the application of one of the larger firms of the city for the use of 100 horsepower from the city plant for heating purposes.

"The contracts proposed by the directors of the light and power plant, and which will probably be approved by the council, provide for the sale of power for heating to firms and individuals for a period of five years, with the option on the part of the purchasing firm or individual to extend the contract for another five years, the city, however, to have the right to change or cancel the contract any time after the first five years should it be necessary, upon giving one year's notice. The contracts further provide that between 4 and 7 p. m. during the winter season when the maximum light power is required the city may, if necessary, restrict the firms using electric power for heating to an amount below the maximum named in their contracts."

PROBABLE PRICES—CAPACITY OF PLANT.

"Many of the factories will use the electric power both day and night for heating, and the cost will therefore be very reasonable. As so much of the city's available electric power goes to waste or is unused, except between the hours of 4 and 7 p. m., both the city and the prospective purchasers of the electric power for heating look forward to the installation of the electric heating as an economical proposition. While the price for the electric power for heating has not been definitely determined by the council, the price proposed by the directors is 25 crowns *($6.70) per horsepower per year*, and this will in all probability be the rate fixed by the city council.

"The present capacity of the city electric plant is 8,000 horsepower. Of this amount 4,800 horsepower is now in use, about one-third being used for light and two-thirds for factory power. The city, which

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has a population of 38,000 is constantly installing additional lights and selling additional power to the factories. Although the capacity of the present electric plant is only 8,000 horsepower, the city owns, in addition to the waterfalls used for the power of the present plant, two other waterfalls. By connecting with these and enlarging the plant the city will be able to furnish 25,000 horsepower.

"By the plans and contracts proposed for the installation of electric heating the city will merely sell the power to the firms and individuals desiring to use it, the purchasers themselves installing the heating apparatus. Already a number of smaller firms have made use of the electric power and have purchased and installed German apparatus and fixtures for heating.

"There is just now much newspaper and other favorable comment on the excellent results experienced in the use of the electric heating, and it is generally believed that the stoves now in general use will be rapidly replaced, there being very few buildings in the city equipped with central heating. The matter of heating the city and government buildings with electricity has been much discussed."

ELECTRIC HEATING IN SWEDEN.

(From Consul Stuart J. Fuller, Gothenburg, Sweden, Jan. 6, 1912.)

"Considerable interest has been aroused in Sweden by the announcement that the municipal electric plant of Gothenburg regards most favorably the outcome of the experiments in electric heating conducted by them on a small scale in the winter of 1910-11, and is preparing to make investigations of a more elaborate nature this year.

"The problem of heating at a reasonable cost is a growing one in southern Sweden, and the hope is expressed that it may be solved by utilizing the surplus water power to furnish electrical heat. It is planned to try the scheme in actual pratice by equipping two or three of the 5-story apartment houses found throught the city and testing various devices in actual use.

"The coal in ordinary household use costs the consumer about $5.22 per ton of 2,240 pounds, delivered, and firewood, sawed and split, delivered and piled in the wood cellar, costs, roughly, $9.85 per cord of 128 cubic feet. Wood is the fuel most generally used for heating, despite its high cost. Only a few of the newest buildings are equipped with steam or other central heating systems, although most of the city's population of 168,000 live in large apartment houses and tenements. In all these buildings large title stoves have been built into almost every room. These are designed to burn wood. The heat that these stoves give off is pleasant and the economy of fuel consumption is surprising. They require a minimum of care and attention. A wood fire is started in the morning and allowed to burn down to coals, whereupon all the dampers are tightly closed, confining the heated air and gases to the long winding flues that fill the interior of the stove and bringing the whole to a temperature such that it radiates no small amount of heat. The radiating surface is large, as the stoves usually extend from floor to ceiling. The heat from a single firing is retained for 12 to 15 hours. The wood is almost entirely consumed.

"It is proposed to take advantage of the heat-retaining properties of these porcelain stoves and their uniform pleasant heating effect by means of portable electric-heating elements of a new construction that may be inserted in the ordinary combustion chamber and will

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produce during the night sufficient heat to last throughout the following day. This would make possible the utilization of the large number of stoves already installed and representing no small amount of invested capital and would also supply a demand for the city's surplus current available through the night. This energy is stated to cost the city only one-half ore ($0.00134) per kilowatt-hour ($8.80 per H. P. per annum) plus some minor transforming charges and other expenses.

"It is suggested that the current for heating could best be supplied through a special set of mains, and that heating current could be turned off at the power station at a fixed time in the morning. Should additional heat be desired during the day, the portable electric heater could be removed and the usual wood fire built, for these stoves have no grates and the fire is built in a plain, rectangular fire-brick chamber.

"The local electric power station is a municipal affair, securing part of its power from the waterfall at Trollhattan, about 50 miles away, and generating the balance in Gothenburg in a steam-operated plant.

"Electric heating is not new in Sweden and satisfactory apparatus has been on the market for some time, but both first cost and current consumption have hitherto been too great to bring about anything like extensive use. Well-informed critics here estimate that electric heating can not be made as cheap as ordinary heating until the current can be delivered for 5 ore ($0.00134) per kilowatt-hour. This is one of the points it is hoped to clear up by the experiments to be undertaken by the municipality."

PORTABLE TILE STOVE FOR ELECTRIC HEATING—GREAT NUMBER OF OLD STOVES.

"There is a portable tile stove for electric heating on the market that is claimed to be as effective as the stoves in which fuel is burned. The makers state that their usual size is about 100 by 50 by 30 centimeters (39.37 by 19.685 by 11.811 inches) and has a capacity of 1.5 kilowatts. This, they state, will raise the temperature in a room of 30 cubic meters (39.24 cubic yards) capacity to 10 degrees Cen. (18 degrees F.) in one hour. After the room has been heated, the stove may be switched to another set of connections using less current. It is claimed that the cost of operation on highest current requirement in Gottenburg is 27 ore ($0.0724) per hour, while the lower connections to which it can be switched costs 14 or ($0.03752) and 7 ore ($0.0188), respectively.

"The little town of Boras, which has about 21,000 inhabitants, is considering the sale at very low prices, by the municipal electric plant, of current for household use along similar lines. It is planned to have three tariffs—one in force during the darker part of the 24 hours, with usual charges, for lighting purpose; a lower one (4 to 6 ore, equivalent to $0.0107 to $0.0161 per kilowatt-hour) for current used for cooking purposes; and a very low rate (2 to 2½ ore, equivalent to $0.0054 to $0.00674) during the night for current used to warm rooms and houses by heating up the Swedish porcelain stoves or operating electric heaters of other designs."

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PRODUCTION OF PIG IRON BY ELECTRICITY.

(From Consul Stuart J. Fuller, Gothenburg, Sweden, July 19, 1911.)

"The first report of the experiments in the reduction of iron ore in electric blast furnaces at Trollhatten, in the Gothenburg consular district, has now been made public by the Jarnkontoret, or Iron Institute of Sweden, the co-operative association of Swedish iron manufacturers which with Government support, provided the money necessary to build a plant large enough to approximate ordinary commercial conditions in manufacture on a large scale.

"The total cost of the plant was 320,470 crowns ($85,886), which was $26,800 more than the original estimates. On the basis of the selling price for the product, which was established by the committee in charge as a basis for computing the practicability of the results, the experimental business has, however, been self supporting, even for the short period that it has been in operation.

"Special attention has been given to the construction details of the furnace, the consumption of electrodes, and best form of these to use, the consumption of electrical energy per ton of iron produced, the consumption of coal for the same, and the important problem of gas circulation and possible utilization to best advantage. In charge of these experiments have been a chief engineer, with operating engineers under him in charge of actual operation, collection of data, chemical laboratory, and drawings and calculations—in all, 28 men."

EQUIPMENT OF FURNACE—CONSUMPTION OF ELECTRODES.

"The furnace is stated to have been built with four electrodes, each formed by four electrode carbons placed together in the form of a square. The dimensions of the electrodes are 2,000 by 600 by 600 millimeters (78.74 by 23.622 by 23.622 inches). Electrodes from Hoganas, Sweden, and so-called 'Plania' electrodes from Silesia were experimented with. Those of Swedish make were found to be equally durable but somewhat more uneven. The repairs necessary during the five months of operation are said to have been very light, so far as the smelting room is concerned, 18 hours representing the total. The circulation of the gases and their utilization will require further experiments, which are to be conducted in the present plant. Further investigation as to the best shape and dimensions for the furnace are also on the program.

"The consumption of electrodes per ton of iron is stated to have averaged 10.28 kilos (22.6634 pounds) gross and 5.27 kilos (11.6183 pounds) net for the whole period of operation, but, owing to improvements now developed, it is thought possible to bring down the gross consumption of electrodes to a figure approximating the net. It is also thought that greater economy would result from the use of three-phase current and six electrodes.

"Up to date only unburnt limestone has been utilized, but it is thought that the use of calcined limestone will prove more economical.

"It is stated that the results obtained from this five months of experimental operation warrant the opinion that the question of the economically successful reduction of iron ore in the electric furnace by the use of cheap electric energy has been solved and that the perfection of methods for handling the gases to secure a more effective circulation, if not their utilization, will greatly better the results already obtained."

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CONSUMPTION OF COAL—CHEAP POWER.

"The average consumption of coal for the whole period of operations has come to 922 pounds to the ton of pig iron, as against a preliminary estimate of 741 pounds. However, an average made to cover a considerable proportion of the period of operation showed a consumption of only 816 pounds, and it is hoped to better this result. The statement is made that in the introduction of new metallurgical processes the full utilization of the fuel is never reached without considerable experimentation.

"It is hoped to reach the preliminary estimate of 3 tons of pig iron per horsepower per year in production, although the results so far have been only 2.7 tons.

"Feeling that the Government subvention in the shape of power furnished at a merely nominal rate is now no longer warranted, in view of the success of the experiments; the water-power commission has proposed to raise the price of the electric current furnished to $13.40 per kilowatt year (or $10 per h.p. year), but as the Iron Institute claims that it cannot economically keep its plant going at a rate exceeding $10.72 per annum the question of the adjustment of the rate is under consideration.

"Trials have proved that the product is as well adapted to the manufacture of steel as is the ordinary Swedish pig iron. The steel made therefrom has been tried for various purposes and found to be satisfactory."

PRODUCTION OF PIG IRON BY ELECTRICITY.

(From Consul Stuart J. Fuller, Gothenburg, Sweden, Oct. 14, 1911.)

"The manufacturers of the electric furnace used in the cooperative experiments at Trollhattan state that the number of kilowatt hours required for the production of 1 metric ton of pig iron is, of course, higher for the poorer than for the richer ores. The following approximate figures are given as an average (metric ton—2,204.6 pounds): For reduction of ore 60 per cent iron content, 2,100 to 2,200 kilowatt hours per metric ton; 55 per cent iron content, 2,200 to 2,300 kilowatt hours per ton; 50 per cent iron content, 2,350 to 2,450 kilowatt hours per ton.

"The quantity, by weight, of carbon electrodes consumed in the production of one ton of pig iron has been ascertained to be about 10 kilos gross (including the electrode butts, which cannot be used), but 5.27 kilos net (kilo—2.2 pounds). With the round electrodes, capable of being connected with a scarf joint, now used at Trollhattan, the gross consumption will probably be about 6 kilos.

"The consumption of charcoal varies from 20 to 23 hectoliters (57 to 65 bushels) per ton of pig iron, the lower figure being for iron containing little carbon and the higher for gray iron. For coke, which may be used to the same advantage as charcoal, the consumption should be calculated at 320 to 360 kilos.

"At a furnace of 2,500 horsepower, 10 hours of labor are required per ton of pig iron, but if the furnace is larger, for instance 3,500 horsepower, or if several furnaces are worked at the same time, the labor hours can be reduced to seven or eight. The furnace at Trollhattan has required about 5 per cent of the working time for repairs and stoppages for exchange of electrodes, etc. In newly-built furnaces

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this can probably be reduced. The content of iron in the slag has varied from 1 to 5 per cent, which has corresponded to a loss of ¼ to 2 per cent of iron per ton of pig iron."

COST OF ELECTRIC POWER.

"There is no published tariff of the prices charged for electric power at Trollhattan, but the chief engineer states that the charge to be made is arrived at by adding a consumption price of one-half ore ($0.00134) per kilowatt hour to a fundamental, or base, price subject to agreement. Private establishments in the mechanical industries, using only a few hundred kilowatts, pay base prices varying from 60 crowns ($16.08) to 82.5 crowns ($22.11) per kilowatt year, and, in addition, a fee for cable from the secondary station to the factory in question. For the electro-chemical industry at Trollhattan and for large industrial establishments the price is calculated according to special contracts.

"Consul Fuller has forwarded a copy of the Jarnkontoret's very complete report on the experiments at Trollhattan, and also a copy of a publication issued by the English branch of the company manufacturing the electric furnace. The former is not translated, but the latter is printed in English. Both may be obtained from the Bureau of Manufactures."

AIR NITRATE FERTILIZERS.

(Development of the Process of Manufacture in Europe, July 1910.)

Consul-General Frank H. Mason, of Paris, writing of the production of nitrogen from the atmosphere, and its use for economic purposes, especially as a fertilizer in agriculture, says that as thus far developed in Europe it is a direct sequel to the manufacture of calcium carbid by the application of electric heat to lime and carbon. He continues:

"When this process was discovered some years ago it was assumed that acetylene gas, generated from calcium carbid, would largely supplant coal gas and revolutionize the existing system of artificial lighting. The first essential requisite for carbid production was abundant and cheap electric current and extensive plants were erected along water courses of Europe and preparations made to supply a large and steadily-increasing demand.

"But it was soon found that acetylene gas was a difficult and under certain conditions a dangerous element to manage; its use became restricted to certain locations and conditions, and experience proved that the combined carbid factories had a capacity of about 100,000 tons in excess of the normal demand for that material.

"About this time Frank and Caro, two German chemists, invented a process through which, by combining nitrogen gas with calcium carbid at a temperature of 1,000 degrees C., they could produce a combination of lime, carbon, and nitrogen—in other words, a synthetic nitrate of lime—to which they gave the name of cyanamid of calcium, now commonly known as cyanamid, which contains from 15 to 20 per cent of nitrogen, 60 per cent of lime, and has qualities as a fertilizer similar to sodium nitrate, or Chilean saltpetre. This process was patented in all countries and became the property of a corporate company, with headquarters at Rome and known as 'La Societe Italiana per las Fabrication de Prodetti Azotati.'

"The calcium carbid therefore was ready, the process for converting it into cyanamid by combination with nitrogen was perfected, and it

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only remained to provide an adequate supply of atmospheric nitrogen at a moderate cost. This requirement was met by a process invented by Dr. Carl von Linde, of Munich, which was patented in both France and the United States. By this process atmospheric air, having been first liquefied by compression, is subjected, by subsequent expansion under pressure, to a process of fractional distillation, by which the nitrogen is separated, leaving as a by-product oxygen of 50 to 60 per cent purity, which can be used by burning in the electric arc (sparking) for the manufacture of nitrates and nitric acid. A copy of the French patent for the Linde process is on file in the Bureau of Manufactures.

"The cycle was now complete, and it is through the combination of these two processes—the Linde method for recovering atmospheric nitrogen and the Frank-Caro method of combining nitrogen with calcium carbid for the production of cyanamid of calcium—that European progress hopes to provide for the future an adequate supply of nitrate fertilizer for agricultural purposes.

"Under licenses granted by the central company at Rome there are now established and in operation four or five plants for the production of cyanamid in Germany, one in Italy, one at Budapest, one or more in Norway, one in the United States—the American Cyanamid Company, with offices at New York, and works at Niagara Falls—and one in France, the Societe des Produits Azotes, with offices at Paris and large plants at Notre Dame de Briancon, in the Department of Savoie, France, and at Martigny, Switzerland. The establishment at Notre Dame de Briancon is the only one of its kind in France. It is elaborately described, with illustrations of buildings and machinery, and with complete scientific analysis of the entire process, in the Genie Civil, for August, 1909 (a copy of which is on file in the Bureau of Manufactures).

"This company has a capacity at Briancon of 120 cubic meters of nitrogen gas per hour, and in 1909 produced about 900 tons of cyanamid. This year it has turned out during the year at its two plants in France and Switzerland from 9,000 to 10,000 tons. Even at this increased rate of production it is unable to supply the rapidly-growing demand, as the use of nitrate fertilizers is steadily expanding in France.

"The German companies produced during the year ended May 30, 1909, 3,500 tons of cyanamid, and since that date 3,500 tons. Their capacity is being steadily increased. The largest plant thus far in Europe is that of the Northwestern Cyanamid Company at Odda, Norway, which produces 500 cubic meters of nitrogen gas per hour, and it is reported that the capacity of that establishment is to be doubled. All accounts agree that the demand for cyanamid everywhere exceeds the available supply, and most of the manufacturing companies are planning greatly to increase their productive capacity.

"The society at Paris sells cyanamid in two grades or qualities, according to the percentage of nitrogen contained, as follows: Quality 1, containing 15 per cent nitrogen, 21 to 22 francs per 100 kilos ($40.50 to $42.40 per metric ton of 2,204 pounds); quality 2, containing 18 to 20 per cent nitrogen, 1.42 francs (27.4 cents) per kilo of nitrogen contained.

"As Chilean nitrate is quoted at 1.55 francs (30 cents) per kilo of nitrogen, it will be apparent that cyanamid is already in a position to compete successfully with the natural nitrate in respect to price. It remains to establish their comparative values for the purpose of agriculture."

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Its Efficiency in Agriculture—Other Uses.

"Elaborate experiments have been made with cyanamid in competition with sodium nitrate, sulphate of ammonia, and other chemical fertilizers for stimulating the growth of cereals, sugar beets, potatoes, and other crops. These tests have been made at various places in France, England, and Germany. The reports of these experiments are voluminous and in some minor details conflicting, but they are practically unanimous in according to cyanamid the essential qualities of a high-class fertilizer.

"It can be readily produced with a nitrogen content of 18 to 20 per cent combined with about 60 per cent of lime. It is more stable than Chilean nitrate, dissolves slowly in contact with wet soil, and yields its nitrogen gradually as it is required by the growing plants. Some of its most beneficial effects have been noted in soils deficient in lime, and where it was applied at the time of or a few days previous to the planting of the seed.

"The Agricultural Syndicate of the Department of Vancluse has petitioned the Central Union of Agricultural Syndicates in Paris in favor of erecting on the river Durance, near Sisteron, a plant for the manufacture of artificial nitrates on their own account. This is the first move of the farmers of France to secure an increased supply of the new fertilizer at cost of production and independent of the market as controlled by manufacturing companies.

"Cyanamid is sold in the form of a coarse, dark-colored powder, which is distributed on the land by a two-wheeled planter or drilling machine drawn by one horse. The quantity varies with different crops and soils from 200 to 250 kilos per hectare, or about 200 pounds per acre.

"Nitrogen gas is also used for several minor purposes among which are: (1) In the manufacture of metallic filaments for incandescent lamps, nitrogen is used in heating the filaments where air containing oxygen would oxidize and destroy certain elements in the metal; (2) for manipulating certain liquids which would deteriorate or become explosive by exposure to the air. Nitrogen gas compressed to a pressure of 300 pounds is sold in Paris at prices ranging from 38 to 48 cents per cubic meter."

INITIAL SHIPMENT OF AIR NITRATES FROM NIAGARA FALLS.

In continuance of his previous reports on the manufacture of air nitrates at Niagara Falls, Canada, Consul W. H. H. Webster now writes (February, 1910):

"The first shipment of calcium cyanamid, or lime nitrogen, on the American continent was made from the plant at Niagara Falls, Ontario, on December 14, 1909. The shipment was 300 bags (26 tons), and was consigned to the office of the American Cyanamid Company at Baltimore, Md. It is not the intention of the company to sell directly to the farmer or consumer, as the cyanamid will be sold to fertilizing plants to be used by them in the manufacture of fertilizers. They will use about 300 pounds of cyanamid to the ton of fertilizer. The offices at Nashville, Tenn., and at New York City have been abolished, and the headquarters of the company are now established at Baltimore. Very little, if any, cyanamid will be sold in Canada, as the fertilizer industry is not well developed here. The entire output of the plant will be consigned to the Baltimore office, and as the cyanamid will be used

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for fertilizing purposes only it will go into the United States free of duty. The Niagara Falls plant represents an investment of $500,000, and it is planned to enlarge the plant to produce 40,000 tons of cyanamid per annum. In the near future the capacity of the plant will be 80,000 tons of cyanamid per annum."

PRODUCTION OF ALUMINUM.

(From Consul D. I. Murphy, St. Gall, Switzerland, Aug. 31, 1911.)

"For several years France was the only country producing aluminum, large mines of oxide of aluminum or bauxite, now turning out over 200,000 tons annually, having been opened in the Departments of Var, Bouches-du-Rhone, and Herault. The number of French aluminum factories has increased in the region of the Alps, especially in the Department of Savoie, where there are six establishments. With the two other French factories, it is estimated that the total output is considerably above 25,000 tons annually.

"The reduction plant established in 1889 at Neuhausen in Switzerland has had a most successful existence. Starting with an annual production of 40 tons of aluminum, it turned out no less than 2,621 tons in the first nine months of 1910, valued at more than $840,000. The company, some few years ago, established branches at Rheinfelden, in Germany, and Lend-Gastein, in Austria, and later opened another at Chippis, Canton Valais, Switzerland, all of which are operating successfully. The company is capitalized at $5,404,000 which it is proposed to increase to $6,021,600. Its stock has never yet paid less than 12 per cent; in 1906 it paid 26 per cent on a par value of 1,000 francs ($193).

"The Swiss control of the aluminum market, which had existed for several years, passed away with the opening of the American factories at Niagara, for neither Switzerland nor France possesses such rich mines of oxide of aluminum and *such sources of electrical energy* as the United States. Negotiations were begun a year ago with the view of limiting the production of aluminum and keeping up the prices, but owing to the attitude of the American producers, the movement has not been successful up to this time.

"Aluminum has become indispensable in the construction of automobiles, dirigible balloons, and aeroplanes. It is employed also in paper decorations and for wrapping purposes. It has been found of enormous advantage also in the textile industry. Combined with silk, it makes a brilliant fabric, which can be given any desired color and which cannot be excelled for making ceremonial costumes and theatrical wardrobes. In addition to the ordinary uses, it is also employed in the manufacture of reticules, scarfs, and various articles of use and ornament, and because of the high price of copper it has been largely used as a substitute for that metal in the manufacture of electrical cables."

PAPER PULP INDUSTRY.

"In New York State 23.0 h. p. per employee is used in the manufacture of paper pulp, and 13.33 h. p. per employee in the making of paper." For the reason that the power consumption per employee is so great, the pulp industry tends to seek power sites remote from centers of population and it is felt that the future expansion of this industry will be to points where power will be cheaper than it is likely to be in New York. (Eng. Record Sept. 14, 1912).

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ELECTRIC REDUCTION, IRON AND STEEL IN UNITED STATES.

(Engineering Record, Sept. 14, 1912, p. 282.)

"A Ten-ton Electric Furnace for the refining of steel is to be installed in the proposed extension of the Bethlehem Steel Company. This announcement is of interest because there are comparatively few electric furnaces in the steel mills of the United States. Probably the number of plants where they are used will not exceed six or eight, and the output from them is very small. Yet it is a new thing, and men like John Fritz who have grown up with the steel industry predict that electricity will play an increasing part in the manufacture of steel in the future. The largest electric steel-refining furnaces in operation in this country are two Heroult furnaces of the Steel Corporation at South Chicago and Worcester, Mass., each of 15 tons capacity. The 10-ton furnace of the Bethlehem Steel Company will be of the Girod type, which differs from the Heroult type by the provision of steel electrodes embedded in the hearth. Some very fine steels are made in electric furnaces, the quality of the products being that of crucible steel, although the cost of the electric furnace process is considerably less than that of the crucible process on account of the larger unit of furnace and reduction in attendance and maintenance cost. Of course the electric power is an item that should be kept as low as possible, but it is by no means a decisive element in steel refining. At Bethlehem the by-product coke works now nearing completion will probably exert considerable influence on the question of power, because practically all gas generated will be utilized at the steel works. The situation is entirely different in such cases where an electric furnace is intended as a competitor to the blast furnace for reduction of iron ore. In this case the cost of power is of prime importance, so that the *electric reduction furnace is suitable only under particularly favorable conditions, such as exist in Sweden and Norway and in California.* The two commercial pioneer plants of the electric iron reduction furnace are at Trollhattan, Sweden, and in Shasta County, Cal. At both places the availability of cheap electricity generated from water power and the scarcity of coke were the decisive elements which determined the erection of electric furnaces. But this problem of reduction of iron ores in the electric furnace should in no way be confounded with the question of electric steel refining, as they are entirely different problems both in technical and commercial aspects."—Eng. Record, Sept. 14, 1912.

FERTILIZER USED IN THE UNITED STATES.

The value of all products of the fertilizer industry proper for 1909, including the fertilizer by-products of other industries was 5,614,718 tons, valued at $100,048,096. During the period, 1899-1909, the tonnage increased 100.9 per cent. (10th Census of the U. S.)

INDUSTRIAL CONDITIONS AT NIAGARA FALLS.

(By Consul Edwin W. Trimmer, Sept. 7, 1912.)

Industrial conditions in the consular district of Niagara Falls during 1911 showed substantial improvement over preceding years, and from present indications the volume of trade for 1912 will show a still greater gain.

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Cheap and reliable hydroelectric power, with unexcelled transportation facilities (both rail and water), natural gas, and other industrial advantages, have attracted the attention of manufacturers, especially in the United States, and many new industries are yearly added to the number operated, manufacturers in many instances finding it greatly to their advantage to operate plants on both sides of the border under one executive head.

EMPLOYMENT OF ELECTRIC POWER.

The municipalities of Niagara Falls, Welland, and St. Catherines, and smaller towns located along the Welland Canal, are prepared to deal liberally with manufacturers locating in Canada in providing cheap factory sites and a reasonable exemption from taxation. The three power companies located on the Canadian side at Niagara Falls could, with the equipment at present installed, generate approximately 250,000 electric horsepower, of which probably not more than 50 per cent is at present utilized, and a large percentage of that is transmitted into the United States. To the power development at Niagara Falls should be added 60,000 horsepower generated at Decews' Falls, and lesser amounts at various points along the Welland Canal, all within a distance of 12 to 15 miles of this city.

Manufacturers of artificial abrasive, cyanamide, calcium carbide, artificial graphite, and other electrochemical products, are now the largest users of electric power in Niagara Falls. The industries mentioned require 1,000 to 6,000 electric horsepower each, practically all of which is consumed in generating the intense heat necessary to operate the electric furnaces used in their various processes. Many smaller enterprises (practically all branch American factories) requiring 10 to 50 horsepower, have been established in this city within the past few years, manufacturing silverware, hats, shirts, neckwear, suspenders, corsets, paper boxes and sacks, chewing gum, carriage fittings, carpet sweepers, aluminum novelties, cement block machines, and many other articles; while at Welland, St. Catherines, Thorold, and other points in this consular district, are located numerous plants financed by American capital, manufacturing iron and steel products, automobiles, electric appliances, cordage, agricultural implements, wood pulp and paper, etc.

Niagara Falls and other small cities and towns in this section of Canada are steadily increasing in population. In this city during 1911, 102 permits were issued for the erection of buildings estimated to cost $250,000. In St. Catherines, 120 permits were issued for buildings estimated to cost $266,000, and the growth of Welland, Port Colborne, Port Dalhousie, Thorold, Merritton, and other towns in this vicinity, have undoubtedly grown in like proportion.

PUBLIC CONTROL OF POWER IN URUGUAY.

(From American Minister Nicolay A. Grevstad, Montevideo, Jan. 22, 1912.)

PROPOSAL FOR STATE MONOPOLY OF ELECTRIC POWER.

The Congress of Uruguay has under consideration a message from the President which proposes to confer upon the State the exclusive right to generate and distribute electric energy for light, motive power, heat, and other uses in the Republic.

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The President, in a message supporting the bill introduced by the Government, reviews the history of electric service in Montevideo briefly, as follows: The electric plant of the capital has advanced through three stages of development—(1) as a private company (1887-1898), (2) as a provisional public enterprise (1898-1905), and (3) as an enterprise under direct and definite public management (since 1905).

GOOD RESULTS FROM MUNICIPAL MANAGEMENT.

The results of its operation are summarized as follows: The number of subscribers has increased from 184 in 1889 to 12,664 in 1910-11. The number of incandescent lamps in private use has increased from 2,550 in 1899 to 200,584 in 1910-11; incandescent lamps in public use from 2,230 in 1889 to 4,519 in 1910. The distribution of motive power was organized by the law of 1906 and began in 1908, and the sale has increased from 821 horsepower in 1908 to 5,361 horsepower at the present time. The gross receipts have increased in a corresponding ratio from 40,698 pesos (Uruguayan gold peso—$1.034 United States currency) in 1889 to 895,974 pesos in 1910-11. The financial results show that the deficit of 4,585 pesos in 1889 has been converted into surplus of 556,566 pesos in 1910-11. Electric light is now cheaper in Montevideo than in any other city in South America except Rio Janeiro and Sao Paulo, Brazil, where the cost is slightly less than here.

The President calls attention to the fact that the reorganization of the electric-light service in Montevideo was accomplished by the law of 1906, and he asserts that the result has exceeded all expectations. He adds that this has been accomplished with a comparatively small capital, namely, 1,240,861 pesos.

The electric-light plant of Montevideo is now managed by the municipality (for the State) and the receipts go into the city treasury. The President believes that the general Government (the State) should assume the district ownership and management under a financial arrangement, provided for in the proposed bill, which will relieve the city of all obligations contracted in connection with the plant and secure to it an annual income from the Government on this account of 670,000 pesos. This will enable the city to raise a loan of 6,000,000 pesos, which the President states is imperatively needed for pressing municipal improvements.

ELECTRIC PLANTS FOR MANY CITIES.

But the State monopoly of electric energy should not, in the judgment of the President, be confined to Montevideo. The centralization of the management of all electric-light plants in the hands of the State Board provided for in the bill under consideration will, in the opinion of the President, result in savings in the purchase of material, machines, installation, etc., and thus give the interior of the country the benefit of the experience and improvement obtained in Montevideo.

At present electric service is supplied, or about to be installed, by private concerns in the cities of Salto, Minas, Paysandu, San Jose, Duranzo, Florida, Rocha, Rivera, Trinidad, Carmelo, Melo, and Mercedes, while Fray Bentos has a municipal plant. The proposed bill confers upon the State Board of Electricity the exclusive right to supply electricity to third parties, provides that service shall be furnished wherever

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needed, and empowers the chief executive to redeem or expropriate existing concessions and prescribes that, excepting Montevideo, profits shall go to lowering rates and extending the service.

As regards the financial side of the proposition, the message proposes raising a loan of 4,500,000 pesos, bearing 5 per cent interest. Of this amount, 2,100,000 pesos will be needed for taking over the plant in Montevideo, for improvements, and other purposes, while it is estimated that 2,000,000 will be needed for the cities and villages of the interior, leaving 400,000 pesos for contingent needs that may arise.

FUTURE OF THE AIR-NITRATE INDUSTRY.

(By T. H. Norton, March 4, 1911.)

It seems certain that the manufacture of nitric acid and the nitrates from the atmosphere is established upon a firm basis and destined to expand steadily within the limitations fixed by the two main controlling factors: First the cost of the available electrical energy, and second, the market rate, for the time being and certainly for a fair share of the present century, of Chile salt-peter. These may be considered somewhat in detail.

COST OF ELECTRICITY FROM WATER POWER.

There is great diversity in the cost of water power available for generating electricity. In central Europe, in the Alps, and also in the Pyrenees, there are isolated cases, as noted, where the power is extremely cheap. As a rule with the extension of the use of electricity for illumination, for motive power, in chemical industries and metallurgy, the value of water privileges mounts steadily, and must eventually be measured by steam or gas engines. In certain countries isolated to some extent from the great industrial movement of the age, such water rights can be secured at present at exceedingly low rates. This is notably the case in Iceland, where English capital is planning to utilize vast water powers of fairly constant flow throughout the year, at a cost not to exceed 48 cents per horsepower year. Western Norway is peculiarly favored in a combination of heavy precipitation, a great number of mountain streams, and marked uniformity of flow during the year. These valuable features gradually diminish on advancing eastward across Sweden and Finland. The cheapest source of energy in Norway is at Odda on the west coast, where it costs $1.96 per horsepower year. The cost advances to $2.94 at Notadden, and ranges up to $12 in eastern Norway. In Sweden there are some instances where power is secured at rates from $6 to $12. In most cases it costs over $12. In the United States the range is from $2.50 at Sault Ste. Marie to $12-$20 at Niagara Falls. There are possibilities in Alaska where heavy precipitation is combined with great elevation. There would appear to be great possibilities on the Zambezi, and along the slopes of the mountain regions of equitorial Africa, as well as on the eastern slopes of the Andes. It is the peculiarity of the air-nitrate industry, employing water, air, and limestone almost exclusively as raw materials, that it can be located in the most inhospitable regions, provided that ample water is available and that transportation to the seaboard is not costly.

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COST OF ELECTRICITY DERIVED FROM COAL.

The engineers in charge of the Notadden and Saaheim works informed me that they confidently expected a gradual increase in the efficiency of the furnaces. With some increase it may be possible at an early date to use coal as a source of energy for the production of nitric acid at least, and possibly for nitrates. By using blast-furnace gas of about 900 calories in the largest type of gas engine it is possible to generate electricity cheaper than by any other means than water power. The kilowatt hour costs in this case 0.357 cent, or $23 per horsepower year. In the large power house at Louisenthal there are three steam turbines, each of 3,000 kilowatts. The cost there is 0.714 cent per kilowatt hour, or $46 per horsepower year. Were it possible to locate this power house at a coal mine, so as to avoid transportation expenses, the cost would be brought down to 0.476 cent, or $30.70 per horsepower year. *Ordinary steam engines are able to generate electricity under favorable condition at $61 per horsepower year.* It must not be forgotten that with each year there are improvements in the transformation of heat into electrical energy. In the Berlin Electrical Works, four years ago, it was possible to secure 111 kilowatt hours from 1,000 calories. In 1911 the yield was 128 kilowatt hours. While such progress is being made with the use of steam as a source of power, it is probable that the highest economy can be attained by the aid of powerful gas engines.

It is hence quite probable that at no distane date the air-nitrate industry may not be exclusively dependent on cheap water power as a source of electrical energy.

PROPOSED WATER POWER LAW OF NEW YORK.

In order that those interested in a detailed study of this plan, may profit by the experience of other states working along similar lines, we deem it advisable that the law proposed for adoption in New York State be printed in full. This law is patterned after a similar law now in force in the Province of Ontario, Canada, but differs as to a few conditions peculiar to New York State.

Since this bill goes into considerable detail as to the relation of the state power commission to various municipal and other organizations, we believe it will be of interest to many citizens who are now earnestly studying municipal problems.

STATE WATER POWER ACT, PROPOSED FOR ADOPTION

By the Legislature of New York.

(Introduced by Mr. Bayne, February 29, 1912.)

State Service of Water, Power, Energy or Electricity and Steam Regulation.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Sec. 400. General powers of the commission.
Sec. 401. Plans, specifications and estimates.
Sec. 402. Service to municipal corporations.
Sec. 403. Contracts for distribution.

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Sec. 404. Special elections.
Sec. 405. Purchase or construction of distributing plants.
Sec. 406. Regulations.
Sec. 407. Renewal of contracts.
Sec. 408. Commission may construct transmission lines.
Sec. 409. Estimates and contracts for construction.
Sec. 410. Stream regulation.
Sec. 411. Canal waters.
Sec. 412. Appropriation of property.
Sec. 413. Limitation of state liability.

Section 400. General powers of the commission. For the purpose of conservation of the natural resources of the state and the progressive development thereof under state ownership, control and maintenance, for the public use and benefit, and for an increase of public revenue, the conservation commission, in addition to its other powers shall have the power:

First.—To regulate the flow of water.

Second.—To acquire by purchase, contract or lease, as provided in this act, or by condemnation or appropriation in the name of the people of the State of New York, water, sources of water supply, lands, water privileges, franchises, water-rights, water works, machinery, water water power, plants, right of use of water or power, or any part thereof, to develop, conserve, impound, lease, distribute or utilize the same or the energy therefrom, to improve water-sheds and flow lands.

Third.—To construct, or acquire by purchase, contract or lease, as provided in this act, or by condemnation or appropriation, and to maintain, use and operate all ways, means, works or other property convenient or necessary to the development, transmission, conduction, or distribution of water, power, energy or electricity for municipal, domestic, manufacturing or other uses.

Fourth.—To construct, maintain and operate reservoirs, dams, dikes, structures, ways, means and works.

Fifth.—To contract with municipal, public service and other corporations, public boards and persons, to supply water, power, energy or electricity for municipal, commercial, irrigation or other purposes; and to contract with any person or corporation to regulate the flow of streams, including the utilization thereof for power and the protection of life, health and property from floods and low water; the improvement of navigation; and to contract, as provided in this act, with riparian owners for the use of surplus or impounded waters or power derived therefrom.

Sixth.—To lease, as provided in this act, the flow of water or any surplus or available waters of the canals, or canalized streams, including diversion and other rights held by the state; or to utilize the same for the purpose of developing, generating, transmitting or supplying water power or energy; and to construct, maintain or operate ways, means and works requisite and proper for the power herein conferred.

Seventh.—To acquire by purchase, contract or lease, as provided in this act, or by condemnation or appropriation in the name of the people of the State of New York, all property required by the commission in the exercise of its powers, and to determine what property is necessary for such purpose.

Eighth.—To construct, maintain or operate its structures, ways, means, and works in and upon public streets, highways, places and property, and at such places on canal lands as may be approved by the superintendent of public works.

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Ninth.—To make or cause to be made, plans, specifications and estimates for its undertakings.

Tenth.—To cause examinations and surveys to be made of all property required by it; and for such purpose such commission, its officers and agents may enter upon any public or private lands or waters, and the owner of any private property injured thereby shall be entitled to rercover in the board of claims any damages sustained.

Sec. 401. Plans, specifications and estimates. The commission may cause to be prepared, plans, specifications and estimates of the cost of construction, maintenance and operation of any work proposed to be undertaken by it, together with a description of the project and a statement of the advantages and benefits to accrue from the execution of the work.

Sec. 402. Service to municipal corporations. The common council or the board of aldermen of any city; the board of trustees of any village, or the town board of any town may, in behalf of the municipal corporation, apply to the commission for power, energy or electricity for lighting public streets, highways, public and private buildings, and for heat and power in said municipality, or for water for municipal purposes. The commission may consider such application, and if entertained a public hearing shall be given thereon at such time and place as it may determine. Public notice of such hearing shall be given by publication at least once a week for two successive weeks immediately preceding such hearing, in a newspaper published in such municipality, or if there be none, in a newspaper published in the county wherein such municipality is situate. Said hearing may be conducted by one or more members of the conservation commission, who may subpoena and compel the attendance of witnesses and administer oaths. At the time and place fixed for the hearing any person residing in the municipality and any person or corporation owning an existing plant in said municipality and furnishing residents thereof with power, energy or electricity for lighting public streets, highway, public and private buildings in said municipality, or for heat and power or for water for municipal purposes, may be heard on such application.

The commission shall thereupon determine whether such application shall be approved or denied. If approved, the commission shall proceed to estimate the cost at which such water, power, energy or electricity can be delivered to such municipality and the cost of distributing the same to consumers, and shall determine and fix the terms and conditions of a proposed contract between the state and the municipality in accordance with which the state will furnish the supply of water, power, energy or electricity applied for. Every such contract between the commission and a municipality shall in addition to such other requirements as may be prescribed by the commission provide that such municipality shall pay annually to the state for such water, power, energy or electricity, a sum to be annually determined by the commission which shall not be less than an amount sufficient to pay its proportionate share of a sinking fund for the retirement within a period of time not less than thirty nor more than fifty years, to be fixed by the commission of any bonds issued by the state and the repayment of any moneys appropriated by the state for the purpose of developing and transmitting such water, power, energy or electricity, together with interest thereon at the rate of four per centum per annum and taxes if any, line loss, cost of transmission and equipping, operating, maintaining, repairing, renewing and insuring the works and property, and to cover contingencies, an amount not exceeding five per centum annually upon the gross amount paid by the municipality to the state, and shall also contain a schedule of

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maximum rates and prices at which said municipality shall sell and dispose of said water, power, energy, or electricity to the consumers thereof within such municipality, reserving to the commission the power to readjust such rates annually to the end that the municipality and the citizens thereof shall secure at cost the benefits to be derived from the utilization of said power and water.

Sec. 403. Contract for distribution. If there be in operation in such municipality a plant owned or operated by a private person or corporation, and available for use by such municipality for the distribution of water, power, energy or electricity, such municipality may unless it be the owner of a municipal plant, enter into a contract with such person or corporation in such form and upon such terms and conditions as the commission may prescribe for the distribution of the water, power, energy or electricity to be furnished by the commission. No such contract shall become effective as against the municipality until approved by a majority of the electors voting at a special election called as hereinafter provided.

Sec. 404. Special elections. In case such a contract shall be entered into, the common council or board of aldermen of the city, the board of trustees of the village, or the town board of the town, shall submit to the electors thereof qualified to vote at any general election thereat, at a special election a proposition to determine whether or not such contracts shall be approved. Notice of such special election, and of the submission of such proposition thereto shall be given, and such election shall be conducted in the same manner as an election of officers in such city, village, or town. The provisions of the election law in relation to the submission of propositions, and the form of the ballot therefor shall apply thereto. The proposition shall be submitted in the following form:

"Shall the municipality enter into the proposed contract with the state for power, energy or electricity for the purpose of lighting the public streets, highways, public and private buildings in the municipality, and for heat and power" or "for water" (as the case may be), and in cases where no municipal plant exists, "and shall the municipality enter into a contract with (here insert the name of the person or corporation) to distribute the same?"

Before holding such special election a brief summary of the contract and proposed contracts, together with the estimates of cost to the municipality and private consumers thereof, shall be published by such municipality in a newspaper published therein once in each week for three successive weeks immediately preceding such election, or, if there be none, in a newspaper published in the county wherein such municipality is located.

Unless a majority of the electors voting at such election vote in favor of such proposition, the application shall be denied.

If a majority of the electors voting at such election shall vote in the affirmative on such proposition, the municipality through its officers hereinbefore mentioned shall execute such proposed contract with the commission acting in behalf of the state, and contract with such private person or corporation shall thereupon become effective, and the commission shall have power and authority subject to the conditions herein contained to enter into the proposed contract with such municipal corporation to supply and transmit to such municipal corporation, power, energy, or electricity for the purpose of lighting public streets, public and private buildings in said municipality and for heat and power, or water for municipal purposes.

Any person or corporation owning or operating an existing plant

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who shall enter into a contract as herein provided, shall not be subject to the jurisdiction of the public service commission with respect to prices for service fixed by the terms of such contract.

Sec. 405. Purchase or construction of distributing plants. In the event that the person or corporation owning or operating an existing plant shall omit or refuse to enter into the contract as hereinbefore provided, or if there be no existing plant therein, then said municipality may cause to be prepared plans, specifications and estimates for the construction of a distribution plant. Such plans, specifications and estimates shall be subject to the approval of the commission. When so approved said municipality through its officers aforesaid shall call a special election of the electors thereof upon such notice and in the same manner as hereinbefore provided, and shall submit to such electors the following question:

"Shall the municipality enter into a contract with the state for power, energy or electricity for the purpose of lighting public streets, highways, public and private buildings in said municipality and for heat and power or for water for municipal purposes (as the case may be), and shall such municipality purchase or construct a distribution plant at a cost not to exceed ..... dollars?"

If a majority of the electors of the municipality voting at such election vote in favor thereof, the municipality through its officers shall enter into a contract with the commission, and the commission in behalf of the state shall have the power and authority, subject to the conditions herein contained, to enter into and contract with such municipal corporation to supply, transmit and deliver to such corporation power, energy or electricity for the purpose of lighting public streets, highways, public and private buildings in said municipality and for heat and power or for water for municipal purposes.

Sec. 406. Regulations. Every municipal corporation which has entered into a contract with the state under the provisions of this article shall keep posted in a public place in the office of the clerk of said municipal corporation, a schedule of rates to be charged to consumers for such water, power, energy or electricity, which shall not exceed the maximum prices fixed by the commission, and the same shall be open for inspection by the public during business hours in such office, and said municipal corporation shall, under proper regulations supply at the rates named in the schedule without discrimination said power, energy or electricity to the public:

First.—For lighting of public streets, highways and buildings.

Second.—Domestic and commercial lighting.

Third.—Power for municipal purposes.

Fourth.—Power for public service corporations.

Fifth.—Power for manufacturing or for private uses.

And said municipalities shall keep such books of account as the commission shall from time to time prescribe, which shall at all reasonable hours be open to inspection and examination by the commission or its duly authorized representatives, and in the event of any discrimination in rates or charges in excess of the amount fixed by the said municipal corporation, the commission may make such order therein after hearing the officers of the municipal corporation in relation thereto or any other person interested as the commission may deem proper, and upon a failure to comply with any of the terms of such order, the commission may apply to the Supreme Court of the judicial district, in which said municipal corporation is located for a mandamus to enforce said order, and for a continued violation thereof said municipality or officer thereof

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shall be liable to a penalty to be recovered by said commission of one hundred dollars for each day such municipality or officer shall continue to violate such order, and in addition thereto the commission may in its discretion terminate such contract.

Sec. 407. Renewals of contracts. The renewal of any contract between the commission and such municipality shall be made in the manner required for the making of the original contract, save that the municipality shall not be required to contract with the owners of plants constructed after the making of the original contract, for the distribution of such water, power, energy or electricity.

Sec. 408. Commission may construct transmission lines. The commission is authorized, when available appropriations have been duly made, to construct or acquire by purchase, lease, appropriation or condemnation, transmission lines from the location where power is developed and provide the necessary means of transmission of power, energy or electricity so developed in order to conduct, store, transmit and supply electricity, power or energy, as provided in this article, and to contract for the transmission of power, energy, or electricity, and with lines, wires, poles, conduits, motors or other conductors or devices to receive, conduct, convey, transmit, distribute, supply or furnish such power, energy or electricity at any place, through, over, under, along, across any lands, public highways, bridges, viaducts, railways, water or water courses and over and across any of the lands owned by the state and at such places on lands owned by the state for the purposes of the canals as shall be approved by the superintendent of public works, and along and over such other rights of way as it may obtain or acquire for the purpose of the utilization and transmission of the power, energy or electricity developed, and the commission shall have power and in the manner and in the places aforesaid to provide the necessary means for distributing and supplying water for municipal purposes, and in the same manner to acquire and use lands for said purposes.

Sec. 409. Estimates and contracts for construction. The commission when it shall enter upon the development of hydraulic power or the transmission of power, energy or electricity, shall make an estimate of the cost and expense of such development or transmission together with the necessary plans and specifications relating thereto, and when appropriations are available therefor shall advertise for proposals for the construction and completion of said work, including installation necessary for the development of power and the transmission of power, energy or electricity, and may enter into contracts with the lowest responsible bidder who shall give approved security for the performance of the same and completion of said work. The contract shall be approved as to form by the attorney-general of the state, and the sufficiency of the security given by such contractor shall be approved by the commission.

Sec. 410. Stream regulation. In case the commission shall contemplate the improvement of any stream by the construction of reservoirs, dams or other structures for the purpose of regulating the flow thereof by impounding the waters therein for the development of power as provided for in this article, and it appears that any riparian owner on such stream has any right or interest in the use of waters so impounded, the commission may enter into a contract in the name of the state with such riparian owner. Such contract shall fix and determine the value of any benefits which may accrue to such owner by reason of the regulation of the flow of such stream and the amounts to be annually paid to the state by such owner on account of such benefits. Such amount

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so fixed and determined shall not be less than twenty dollars per year for each foot of fall available to such owner for each one billion cubic feet of created or increased storage capacity of such reservoirs, dams or structures used for storage or impounding waters.

No such contract shall be made for a period exceeding fifty years and such contract shall:

1. Release to the state any claim of such owner for damages present or prospective by reason of impounding such waters and regulating the flow of such stream or any work necessary to be carried on in the construction of reservoirs or other structures convenient to a control and regulation of the same.

2. Grant to the state in perpetuity all the right, title and interest of such owner in and to the use of any water impounded or which may be impounded and the right to impound the waters of said stream at any time for the purpose of regulating the flow thereof, together with all the right, title and interest of such owner in and to the use of any and all power made available by any such impounded water. Such contract shall contain a description of the lands affected by said contract, and shall be recorded in the office of the clerk of the county where such property is located, and shall be binding and effective against the party, person or corporation executing the same, their heirs, successors, and subsequent purchasers, and the amount agreed to be paid by such owner by the terms of such contract shall be a lien upon the lands and property so described and the contract for payment shall be covenant running with the land; such contract shall also contain such other and further terms, provisions and conditions as the commission may determine. The making of such contract with a riparian owner by the conservation commission shall not confirm to such riparian owner or impair any right in the people of the state to the use of the natural flow of any stream for hydraulic power or any public right in the use of the waters thereof. No liability on the part of the state shall arise in case performance on the part of the state of a contract so entered into shall cease, but in that case all rights in the state to payments to accrue thereafter, and all rights granted to the state by riparian owners above provided shall revert to such owner, his heirs, successors or assigns.

Sec. 411. Canal Waters. Whenever the superintendent of public works shall certify to the commission that at points to be specified by him surplus or other waters of the canals and canalized streams of the state, including diversion or other rights held by the state of waters for the purpose of the canal are available for hydraulic uses, the commission may utilize such waters either by leasing the same after a public hearing thereon. Notice of the time and place of said hearing shall be published once in each week for two successive weeks in two newspapers published in the county where said water is located, to municipal corporations or private users, when the same can be advantageously leased in the interest of the state, or if the said commission determine that said waters may be utilized to better advantage thereby, the same may be utilized as provided by this act. Any lease so made of such waters shall be subject at all times to the needs and requirements of navigation of the canals and to the jurisdiction of the superintendent of public works and may be revoked for non-user. Any such lease shall be transferable only on consent of the commission and no lease shall be made for any term exceeding twenty-five years from the date of the same and shall provide for a rental payable annually and may be renewed at the option of the state within one year of the expiration thereof for a period of not more than twenty-five years from and after the expiration of the

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same. A lease shall contain such other provisions as will in the opinion of the commission protect the state in the collection of any rental to be paid therefor or otherwise and shall provide for readjustment of such rental at the end of every five year period. Canal structures under contracts hereafter made shall be so constructed and the canals shall be so operated as to facilitate so far as practicable such utilization of canal waters, and all gates through which surplus or other available waters may be drawn shall be constructed by the state and located and maintained upon canal lands belonging to the state.

Sec. 412. Appropriation of property. The commission may enter upon and take possession of any lands, structure, water privileges, water rights or any part thereof, water works, or plant, electrical power or energy where said waters or power are available, to be utilized as herein provided, the appropriation of which in its judgment shall be necessary for the purposes specified in this act. An accurate survey and map and description of such lands, plant or property, or the amount to be taken or appropriated, shall be made by the commission. It shall endorse on such description a certificate stating that the lands, structures, water privileges, water rights or part thereof, water works, plant, electrical power or energy or property described therein are necessary for and have been appropriated by the State for public use pursuant to the provisions of this act. Such description and certificate shall be filed in the office of the commission, and a copy thereof certified by the commission shall thereupon be served upon the owner, together with a notice of the filing and of the date of filing such description and certificate in the office of the commission; and from the time of such service the entry upon and appropriation by the State of the property described in such description and notice for the use and purposes above specified, shall be deemed complete and thereupon such property shall be deemed to be the property of the state.

Such notice shall be conclusive evidence of an entry and appropriation by the State, but the service thereof shall raise no presumption that the lands and rights therein mapped or described are private property. A duplicate of such notice and affidavit of due service thereof on such owner shall be recorded in the record of deeds and conveyances in the office of the clerk of any county where any of the property described therein may be situated, and the record of such notice and of such proof of service shall be evidence of the due service thereof.

The commission may enter into an agreement with the owner of any lands, water privileges, water rights, or any part thereof, water works, plant, electrical energy or power, or other property so taken and appropriated, for the value thereof, and as to the amount of any damage resulting from the appropriation for which the State shall be legally liable. If such agreement shall be made, the commission shall deliver to the owner a certificate stating the amount due to him on account of such appropriation, and a duplicate of such certificate shall be delivered to the comptroller. The amount so agreed upon shall be paid by the treasurer upon the warrant of the comptroller, after title to said property has been certified by the attorney general of the State, upon an abstract to be furnished by said claimant which shall show a good title to said property as appropriated by the State in said claimant, free from all encumbrances, dower right or liens of any name or character.

If the commission is unable to agree with the owner upon the value of any property so taken or appropriated, or on the amount

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of damages resulting therefrom, such owner, within two years after the service upon him of the notice of appropriation, as above specified, may present to the board of claims a claim for the value of such property so appropriated and any damages resulting therefrom for which the State shall be legally liable. The board of claims shall have jurisdiction to hear and determine such claims and make an award thereon. Any final award made upon such claim so filed against the State shall be paid in the manner provided by law, by the comptroller, for the payment of awards made by the board of claims.

When damages are awarded and it appears that there is any lien or encumbrance on the property appropriated, the comptroller may deposit the amount awarded in any bank in which moneys belonging to State funds may be deposited, to the account of such award, to be paid and distributed to the persons entitled to the same as ordered by the Supreme Court.

Whenever any lands or waters or any use thereof is necessary for the carrying out of any improvement or works herein provided for, and the same are in possession of, or being used by any person or corporation under any privileges heretofore given by the State by statute or otherwise and which is revocable by the State or where any lands, waters, or use thereof belonging to the State are held under a term which has expired, the commission shal have power to revoke such privilege on behalf of the State and to re-enter and use said lands and use such waters and no damages shall be awarded against the State on account thereof. The commission is hereby empowered to enter upon and use any lands or waters, property of the State, outside the canal system convenient, or necessary for the carrying out of any improvement or works authorized by this article.

Sec. 413. Limitation of State liability. No contract made under the provisions of this article shall operate to obligate the State beyond appropriations duly made by law, or to subject the State to any damages by reason of nonperformace of the terms of any contract so entered into, nor render the State liable for any damages on account thereof.

Sec. 2. All acts or parts of acts inconsistent with this act are hereby repealed.

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OREGON'S FOREST LAW.

This law became operative in 1911. It established for the first time in Oregon a means by which systematic study of forest conditions could be undertaken and made possible the employment of a corps of wardens for purposes of law enforcement and patrol of timbered sections.

OREGON FOREST FIRE LAW.

Chapter 278 of the Laws of Oregon for 1911, Enacted by the Twenty-sixth Legislative Assembly as House Bill No. 50.

An Act for the protection of the forests of the State of Oregon; to prevent and suppress forest fires, to create a State Board of Forestry to serve without compensation, and a State Forester and deputy, and for the appointment of fire wardens, and to prescribe their rights, powers and duties, and to provide for the payment of their compensation and expenses and the expenses of said Board; providing penalties for the violation of the provisions of this act, making an appropriation therefor; repealing Sections 5508, 5509, 5510, 5511, 5512, 5513, 5514, 5515, 5516, 5517, 5518, 5519, 5520, 5521, of Lord's Oregon Laws (Chapter 131 of the Laws of Oregon for the year 1907), and declaring an emergency.

Be it enacted by the People of the State of Oregon:
Be it enacted by the Legislative Assembly of the State of Oregon:

Section 1. There shall be a State Board of Forestry, consisting of the Governor, the acting head of the Forest School of the Oregon Agricultural College, and five electors of the State of Oregon, to be appointed by the Governor from and upon the authoritative recommendation of the Oregon State Grange, the Oregon Forest Fire Association, the Oregon and Washington Lumber Manufacturer's Association and the United States Forest Service, and Oregon Woolgrowers' Association, each to select and name one of such electors. In the absence of such recommendation the Governor shall nevertheless appoint said electors. Said Board of Forestry shall supervise all matters of forest policy and management under the jurisdiction of the State, and approve claims for expenses incurred under the provisions of this act. The members of said Board shall receive no compensation for their services thereon but shall be entitled to actual traveling expenses which may be incurred in attending Board meetings.

Said Board shall meet at any convenient place in the State upon the call of the Governor or its secretary. A majority of said Board shall constitute a quorum.

Section 2. The State Board of Forestry shall appoint a State Forester, who shall be a practical forester familiar with western conditions and experienced in organization for the prevention of forest fires. He shall hold office at the pleasure of said Board, which shall also have power to fix his compensation at not to exceed three thousand dollars ($3,000) per annum. He shall be authorized and empowered to appoint a deputy whose salary shall be fixed by the State Board of Forestry at not to

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exceed eighteen hundred dollars ($1800) per annum. He shall be allowed necessary office and contingent expenses, including clerical help, and he and his deputy shall be paid actual traveling and field expenses which may be incurred in the performance of their official duties. He shall, under the supervision of the State Board of Forestry, execute all matters pertaining to forestry within the jurisdiction of the State; appoint and instruct fire wardens as provided for in this act; direct the improvement and protection of State forest lands; collect data relative to forest conditions; take such action as is authorized by law to prevent and extinguish forest, brush, and grass fires; enforce all laws pertaining to forest and brush-covered land and prosecute for any violation of said laws; co-operate with land owners, counties or others in forest protection; advise and encourage reforestation; and publish such information on forestry as he may deem wise. He shall act as secretary of the State Board of Forestry and prepare annually a report to the Governor on the progress and condition of State forest work, containing recommendations for improving methods of forest protection, management and reproduction within the State of Oregon. During the State Forester's absence or disability, all his authority shall be exercised by his deputy.

Section 3. Under such general policy as to qualifications, numbers and localities as the State Forester shall deem wise, he shall appoint suitable and proper citizens fire wardens who shall have all the powers given to fire wardens under this act, but shall serve voluntarily or under compensation by property owners or counties. State and county officials whose duties make their *ex officio* services as fire wardens especially desirable as a convenience to the public, shall accept appointments as such when formally requested by the State Board of Forestry. Upon the recommendation of federal forest supervisors, the State Forester shall appoint resident officers of the national forest *ex officio* fire wardens. In times or localities of particular fire danger, or to enforce the fire laws or apprehend and prosecute violators thereof, the State Forester shall have power to appoint and employ, either independently or jointly with other agencies, such additional fire wardens, and furnish these such assistance and facilities for protecting life or property from fire, as he shall deem public safety demands, and unless contributed by other sources, the cost thereof shall be paid from the funds appropriated by this act, but each county in which such service is given shall be responsible for one-third the expenses thus actually incurred and paid by the State for services within said county and upon demand by the State Treasurer shall pay the amount thus due into the State Treasury, to be credited to the fund appropriated by this act.

Section 4. The State Forester shall, with the advice of property owners or agents or counties desiring to co-operate in forest protection, designate suitable areas to be official fire districts. He may appoint for each district one or more district fire wardens to be paid as other fire wardens under this act and to serve until their appointments are revoked by their employers' request or by the State Forester for good cause shown. Upon written notice to the State Forester by the person or authority upon whose recommendation any other fire warden is appointed, said fire warden shall be subject to the direction of the proper district fire warden.

Section 5. Any and all inadequately protected forest or cutover land adjoining, lying near, or intermingling with other forest land and covered wholly or in part by inflammable debris or otherwise likely to further the spread of fire, which by reason of such location or condition or lack of protection endangers life or property, is hereby declared to be a public nuisance and whenever the State Forester shall learn thereof

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he shall notify the owners or persons in control or possession of said land, requesting them to take proper steps for its protection and advising them of means and methods to that end.

Section 6. All fire wardens appointed under this act shall, under instruction from the State Forester as to their exercise of State authority, take proper steps for the prevention and extinguishment of fires within the localities in which they exercise their functions, assist in apprehending and convicting offenders against the fire laws, control the use of fire for clearing land in the closed season as provided by Sections 7 and 8 of this act, and make such reports of their work and conditions within their localities as may be requested by the State Forester. They shall have the power of peace officers to make arrests for violation of forest laws. They shall have power to enter upon the lands of any person or owner in the discharge of their duties; *provided*, that in so entering they shall exercise due care to avoid doing damage. Any fire warden who has information which would show, with reasonable certainty, that any person has violated any provision of the forest laws, shall immediately take action against the offender, either by using his own power as a peace officer or by making complaint before the proper magistrate, or by the filing of information with the district attorney, and shall obtain all possible evidence. Failure on the part of any fire warden receiving compensation to comply with the duties prescribed by this act shall be a misdemeanor and punishable by a fine of not less than twenty dollars ($20), nor more than two hundred and fifty dollars ($250), or by imprisonment in the county jail for not less than ten (10) days nor more than three (3) months, or both such fine and imprisonment.

Section 7. During the period between June 1st and October 1st, which is hereby designated the closed season, it shall be unlawful for any person or persons to set on fire, or cause to be set on fire, any slashing, chopping, woodland or brush land, either his or their own or the property of another, without written or printed permission from a fire warden and compliance with the terms thereof which shall prescribe the conditions upon which the permit is given and which are necessary to be observed in setting such fire and to prevent it from spreading so that life or property of another may be endangered thereby. This restriction shall not apply to the burning of log piles, stumps or brush heaps, in small quantities, under adequate precautions and personal control, and in accordance with any regulations which may be adopted by the State Board of Forestry for the purpose of insuring public safety; but if any such burning without permission shall result in the escape of fire and injury to the property of another, this shall be held *prima facie* evidence that such burning was not safe and was a violation of this section. Violation of these provisions shall be punished by a fine of not less than twenty-five dollars ($25), nor more than five hundred dollars ($500), or by imprisonment of not less than ten (10) days nor more than three (3) months. Permits to burn, as provided by this section, may be issued by any fire warden, and shall contain such safeguarding restrictions as to time of burning and precaution to be taken as may be fixed by the State Forester or left by him to the discretion of fire wardens. Any fire warden shall have the right to refuse, revoke or postpone permits when necessary to prevent danger to the life or property of another. Any permit obtained through willful misrepresentation shall be invalid and give no exemption from liability of any kind. In times and localities of unusual fire danger, the Governor, with the advice of the State Forester, may suspend any or all permits or privileges authorized by this section and prohibit absolutely the use of fire herein mentioned. Whenever, or wherever, during an

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open season for the hunting of any kind of game in this State, it shall appear to the Governor upon the showing of the State Forester that by reason of extreme drought the use of firearms or fire by hunters is liable to cause forest fires, he may, by proclamation, suspend the open season and make it a closed season for the shooting of wild birds and animals of any kind for such time as he may designate, and during the time so designated all provisions of law relating to closed seasons for game shall be in force.

Section 8. Any person who sets on fire, or causes to be set on fire, any woods, brush, grass, grain, stubble, or other material being or growing on any lands not his own, without permission from the owner, or who willfully or negligently allows fire to escape from his own land, or any one who accidentally sets any fire on his own land or another's and allows it to escape from his control without extinguishing it, or using every effort to do so, shall be punished by a fine of not less than fifty dollars ($50), nor more than one thousand dollars ($1,000), or imprisonment for not less than one (1) month nor more than one (1) year; *provided*, that it shall be lawful to build, in a careful manner, camp fires on any uninclosed lands, the owner of which has not forbidden such building of camp fires thereon by personal notice or by posting such prohibition in conspicuous places or otherwise, if, before departing from the place where such camp fire has been built, the builder of such fire totally extinguishes the same; *and provided further*, that nothing in this section shall apply to the setting of a back fire, in good faith, to prevent the progress of a fire then burning.

Section 9. Any person who builds a camp fire upon lands within this State, not his own, without clearing the ground immediately around it free from material which will carry fire, or who leaves thereon a camp fire burning and unattended, or who permits a camp fire to spread thereon, or who uses in any firearms discharged thereon other than incombustible gunwadding, shall be punished by a fine of not less than twenty-five dollars ($25), nor more than five hundred dollars ($500), and upon refusal or neglect to pay the fine and costs imposed shall be imprisoned for a period not to exceed one day for every two dollars ($2.00) thereof, or may be subject to both such fine and imprisonment at the discretion of the court.

Section 10. From June 1st to October 1st of each year it shall be unlawful for any person, firm or corporation, or employee thereof, to use or operate any locomotive, logging engine, portable engine, traction engine or stationary engine using fuel other than oil, in or near forest or brush land, which is not provided with an adequate spark arrester kept in constant use and repair. Any person, firm or corporation who shall willfully fail to comply with the foregoing provisions of this section shall be guilty of a misdemeanor, and upon conviction thereof shall pay a fine for each engine or locomotive without such spark arrester of not less than twenty-five dollars ($25), nor more than one hundred dollars ($100), and shall be enjoined from further use of such engine or locomotive until such spark arrester is provided. Escape of fire from any engine shall be *prima facie* evidence that such appliance has not been adequately maintained in compliance with this section. Upon proof that any prosecution has been instituted under this section by any fire warden, any court of competent jurisdiction shall enjoin the further use of the engine involved, unless equipped and maintained in compliance with this section to the satisfaction of said fire warden, until the defendant has been acquitted of the charge preferred.

Section 11. All persons, firms or corporations engaged in logging, or permitting logging upon their lands, in this State, shall each year

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burn their annual slashing, by which is meant the tops and inflammable refuse left after lumbering, that may carry fire or cause it to spread, at such time and in such manner and with such provision of help as well confine the fire to their own lands, and if such burning is done between June 1 and October 1 shall first cut down all dead trees or snags over twenty-five (25) feet high. Builders of trails, roads or railroads in this State shall immediately destroy or remove all inflammable material resulting from constructing or clearing for such improvements unless prevented under the provisions of Sections 7 and 8 of this act. Any person, firm or corporation operating a railroad in this State with coal or wood fuel shall annually, or when so directed by the State Board of Forestry, and in a manner and to an extent directed by said Board, destroy or remove all inflammable material from the right of way of said railroad. All burning under the provision of this section shall be in accordance with the provisions of Sections 7 and 8 of this act. Refusal or neglect to comply with the provisions of this section shall be punished by a fine of not less than one hundred dollars, nor more than one thousand dollars ($1,000) for each offense; *provided*, that the State Forester, with the consent of the Board of Forestry, may suspend the restrictions of this section when and where he deems public safety so permits or requires. *It is further provided*, that in the absence of such suspension, and in case of refusal or neglect by any person or persons at fault, after proper notice, to take the precautions against fire required by this section, the State Forester, or district fire warden acting with his consent, may have the work done to the extent he deems requisite to public safety, and the cost thereof and the expense of any fire patrol rendered necessary by the delay shall be recoverable from the offender by action for debt.

Section 12. Any person who shall unlawfully or maliciously set fire to any woods, forest, timber, brush or vegetable matter whatever with intent that the property of another shall be injured thereby, shall be guilty of a felony, and upon conviction thereof shall be punished by imprisonment in the State Penitentiary for not less than one (1) year nor more than ten (10) years.

Section 13. In addition to the penalties provided in this act, the United States, State, county, or private owners, whose property is injured or destroyed by fires in violation of this act, may recover in a civil action double the amount of damages suffered if the fires occurred through willfulness, malice or negligence; but if such fires were caused or escaped accidentally or unavoidably, civil action shall lie only for the actual damage sustained as determined by the value of the property injured or destroyed, and the detriment to the land and vegetation thereof. Persons or corporations causing fires by violations of this act shall be liable in action for debt to the full amount of all expenses incurred in fighting such fires.

Section 14. Any person not employed and compensated as a fire warden who shall detect any one violating any of the provisions of this act, and shall furnish information leading to the arrest and conviction of such person, shall, upon his conviction, receive one-half of the fine paid by such person so convicted, otherwise all fines imposed under this act, less the cost of collection, shall go into the general fund of the county in which conviction is had.

Section 15. Whenever an arrest shall have been made for violation of any provision of this act, or whenever any evidence which shows with reasonable certainty any such violation shall have been lodged with him, the district attorney for the county in which the criminal act was committed must prosecute the offenders with all diligence and energy.

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If any district attorney shall fail to comply with the provisions of this section he shall be guilty of a misdemeanor, and upon conviction shall be fined not less than one hundred dollars ($100), nor more than one thousand dollars ($1,000), in the discretion of the court. Prosecution against the district attorney shall be conducted by the Attorney General. The penalties of this section shall apply to any justice of the peace, with proper authority, who refuses or neglects to issue a warrant for the arrest of any person or persons when complaint under oath of violation of any terms of this act has been lodged with him.

Section 16. The Secretary of State shall, upon request of the State Forester, furnish such printed circulars and cloth notices and such forms and blanks as shall be necessary to carry out and give publicity to the provisions of this act, the cost of providing such circulars, cloth notices, forms and blanks to be paid from the appropriation for defraying the expenses of the public printing, binding, etc., provided for the various State departments, boards, commissions, etc. Any person who shall willfully destroy or injure any notice posted in compliance herewith shall be punished by a fine of not less than ten dollars ($10), nor more than fifty dollars ($50), or by imprisonment for one (1) day for each two dollars ($2.00) of such fine imposed in case of his neglect or refusal to pay such fine.

Section 17. County boards of commissioners may appropriate money for forest protection under the provisions of this act and expenses incurred by any county board of commissioners in accordance therewith shall be a proper county charge.

Section 18. For the purpose of carrying out the provisions of this act, including the payment of the salaries and expenses of the officers and employees for which the State is liable under this act, there is hereby appropriated out of any funds in the treasury not otherwise appropriated the sum of sixty thousand dollars ($60,000), or so much thereof as may be necessary. The Secretary of State is hereby authorized and directed to audit all duly approved claims which have been incurred in pursuance of this act and the foregoing appropriation and to draw his warrant on the State Treasurer in the payment thereof out of the appropriation made by this act or other appropriation from which the same may be determined to be payable.

Section 19. It is hereby adjudged and declared that precautionary measures provided by this act must be taken immediately and before the actual fire season, and that since existing conditions are such that this act is necessary for the immediate preservation of the public peace, health and safety, an emergency is declared to exist and this act shall take effect and be in full force and effect from and after its approval by the Governor.

Section 20. That Sections 5508, 5509, 5510, 5511, 5512, 5513, 5514, 5515, 5516, 5517, 5518, 5519, 5520, and 5521, of Lord's Oregon Laws are hereby repealed.

Filed in the office of the Secretary of State February 24, 1911.

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WATER CODE OF OREGON.

[CHAPTER 216, LAWS OF 1909.]

AN ACT

Providing a system for the regulation, control, distribution, use, and right to the use of water, and for the determination of existing rights thereto within the State of Oregon, providing penalties for its violation and appropriating money for the maintenance thereof, and declaring an emergency.

Be it enacted by the Legislative Assembly of the State of Oregon:
Be it enacted by the People of the State of Oregon:

Section 1. Subject to existing rights, all waters within the State may be appropriated for beneficial use, as herein provided, and not otherwise; but nothing herein contained shall be so construed as to take away or impair the vested rights of any person, firm, corporation, or association, to any water. (L. O. L. § 6594.)

Section 2. *Water Divisions.*—The State of Oregon is hereby divided into two water divisions, as follows:

Water Division No. 1 shall consist of all the lands embraced within the following counties, to wit: Benton, Clackamas, Columbia, Clatsop, Coos, Curry, Douglas, Josephine, Jackson, Klamath, Lake, Lane, Linn, Lincoln, Marion, Polk, Multnomah, Tillamook, Yamhill, and Washington.

Water Division No. 2 shall consist of all the lands embraced within the remaining counties of the State. (L. O. L. § 6609.)

Section 3. *Division Superintendents, Appointments and Term Of.*—There shall be one superintendent for each water division, who shall, immediately after this act become effective, be appointed by the Governor to serve until January 1, 1911, or until his successor is appointed or elected and shall have qualified, and who shall be a resident of the water division for which he is appointed. At the general election in 1910, and every four years thereafter, there shall be elected by the voters of the counties of the first and second water divisions of the State a division superintendent, each of whom shall hold office for the term of four years, or until his successor is elected and qualified. Each of said water superintendents shall have knowledge and experience relative to the irrigation law and its administration, and measurement of flowing water, evaporation, seepage, and common alkalies, drainage and the hydrographic features of the water division in which the candidate may reside. (L. O. L. § 6610.)

Section 4. *Duties.*—Said division superintendent shall have general control over the water masters of the several districts within his division. He shall execute the laws relative to the distribution of water, and shall perform such other functions as may be assigned to him. He shall have authority to make such reasonable regulations to secure the equal and fair distribution of water in accordance with the determined rights as may be needed in his division. Such regulations shall not be inconsistent with the laws of the State. (L. O. L. § 6658.)

Section 5. *Appeal From.*—Any person, association, or corporation who may deem himself, or itself, aggrieved by any such order or regulation of such division superintendent shall have the right to appeal from

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the same to the Board of Control by filing with it a copy of the order or regulation complained of and a statement of the manner in which the same injuriously affects the petitioner's interest. The Board shall, after due notice, hear whatever testimony may be adduced by the petitioner, either orally or by affidavit, and shall have the power to suspend, amend or confirm the order complained of. (L. O. L. § 6612.)

Section 6. *Water Division Superintendent and Compensation Of.*—Each division superintendent shall receive a salary of two thousand four hundred dollars per annum, in full compensation for all his services, and shall in addition thereto be paid his actual traveling expenses when called away from home in the performance of his duties. Such salary and expenses shall be paid at the same time and in the same manner as those of other State officers. Such division superintendent shall not engage in any other business. (L. O. L. § 6613.)

Section 7. *Oath and Bond.*—Before entering upon the duties of his office, each division superintendent shall take and subscribe an oath faithfully to perform the duties of his office, and file with the Secretary of State said oath and his official bond in the penal sum of five thousand dollars, with surety, or sureties, to be approved by the Governor, and conditioned for the faithful discharge of the duties of his office. (L. O. L. § 6614.)

Section 8. *State Engineer.*—As soon as possible after this act shall become effective a State Engineer, technically qualified and experienced as an hydraulic engineer, shall be appointed by the Governor. He shall hold his office until January 1, 1911, unless sooner removed by the Governor for cause, and until his successor shall have been elected and shall have qualified. At the general election held in November, 1910, and every four years thereafter, there shall be elected a State Engineer by the voters of the State, whose term of office shall be four years, and until his successor is elected and qualified. He shall receive a salary of $2400 per annum and actual necessary traveling expenses while away from his office in the discharge of his official duties, payable as other State officers are paid. He shall perform such duties as are prescribed by law, and may employ assistants and purchase materials and supplies necessary for the proper conduct and maintainance of his department in pursuance of appropriations as made from time to time for such purposes. (L. O. L. § 6597.)

Section 9. *Board of Control.*—The State Engineer and the superintendents of the two water divisions shall constitute a Board of Control, which shall, under such regulations as may be prescribed by law, have the supervision of the waters of the State, and of their appropriation, distribution, and diversion, and of the various officers connected therewith. The decisions of said Board shall be subject to appeal to the circuit and supreme courts, which appeal shall be governed by the practice in suits in equity, unless otherwise provided herein. Said Board shall have an office in the Capitol at Salem, and shall hold two regular meetings each year for the transaction of such business as may come before it, the first of said meetings to begin on the second Wednesday in April and the second on the third Wednesday in November. The State Engineer shall be *ex officio* president of said Board, and shall have a right to vote on all questions coming before it. A majority of said Board shall constitute a quorum to transact business. The Board shall have power to adjourn meetings from time to time, and to meet in special session at the call of the president, or of any two members. Notice of any special meeting must be given by registered mail to each member three days before the date thereof, but such meeting may be held at any time when all members of the Board are present. (L. O. L. § 6603.)

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Section 10. *Secretary and Other Assistants; Salary.*—The Board of Control shall have authority, with power of removal, to appoint a secretary, who shall receive a salary of twelve hundred dollars per annum. He may be required by the Board to furnish such bond as it may deem necessary, for the faithful performance of his duties. The duties of the secretary shall consist in keeping a full, true, and complete record of the transactions of the Board of Control, and he shall certify, under seal, all water right certificates made according to law. He shall perform such other duties as may be imposed by law or required of him by the Board. Said Board shall also have the power to employ such other assistants and purchase materials and supplies as may be necessary for the proper conduct of its business. (L. O. L. § 6604.)

Section 11. *Determination.*—Upon a petition to the Board of Control, signed by one or more water users upon any stream, requesting the determination of the relative rights of the various claimants to the waters of that stream, it shall be the duty of the Board of Control, if upon investigation, they find the facts and conditions are such as to justify, to make a determination of the said rights, fixing a time for beginning the taking of testimony and the making of such examination as will enable them to determine the rights of the various claimants. In case suit is brought in the circuit court for the determination of rights to the use of water, the case may, in the discretion of the ocurt, be transferred to the Board of Control for determination as in this act provided. (L. O. L. § 6635.)

Section 12. *Notice of Proceedings.*—The Board shall prepare a notice, setting forth the date when the engineer will begin an investigation of the flow of the stream and of the ditches diverting water therefrom, and a place and a time certain when the superintendent of the water division in which that stream is situated shall begin the taking of testimony as to the rights of the parties claiming water therefrom. Said notice shall be published in two issues of one or more newspapers having general circulation in the counties in which such stream is situated, the last publication of said notice to be at least thirty days prior to the beginning of taking testimony by said division superintendent, or for the measurement of the stream by the State Engineer, or his assistant. The superintendent taking such testimony shall have the power to adjourn the taking of testimony from time to time and from place to place, to suit the convenience of those interested. (L. O. L. § 6636.)

Section 13. *Notice to Claimants.*—It shall be the duty of said division superintendent to send by registered mail to each person, firm or corporation, hereinafter to be designated as claimant, claiming the right to the use of any of the waters of said stream, and to each person, firm or corporation owning or being in possession of lands bordering on and having access to said stream or its tributaries, insofar as such claimants and owners and persons in possession can reasonably be ascertained, a similar notice setting forth the date when the State Engineer or his assistant will begin the examination of the stream and the ditches diverting the waters therefrom, and also the date when the superintendent will take testimony as to the rights to the water of said stream. Said notice must be mailed at least thirty (30) days prior to the date set therein for making the examination of the stream or the taking of testimony. (L. O. L. § 6637.)

Section 14. *Statement of Claimant.*—The division superintendent shall, in addition, inclose with said notice a blank form on which said claimant or owner shall present in writing all the particulars necessary for the determination of his right to the waters of the stream to which he lays claim, the said statement to include the following:

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The name and postoffice address of the claimant.

The nature of the right or use on which the claim is based.

The time of initiation of such right or the commencement of such use, and if distributing works are required.

The date of beginning of construction.

The date when completed.

The date of beginning and completion of enlargements.

The dimensions of the ditch as originally constructed and as enlarged.

The date when water was first used for irrigation or other beneficial purposes, and if used for irrigation, the amount of land reclaimed the first year, the amount in subsequent years, with the dates of reclamation, and the amount and general location of the land such ditch is intended to irrigate.

The character of the soil and the kind of crops cultivated, and such other facts as will show a compliance with the law in acquiring the right. (L. O. L. § 6638.)

Section 15. *Statement to Be Under Oath.*—Each claimant or owner shall be required to certify to his statements under oath, and the superintendent of the water division in which the testimony is taken is hereby authorized to administer such oaths, which shall be done without charge, as also shall be the furnishing of blank forms for said statement. (L. O. L. § 6639.)

Section 16. *Testimony Taken by Division Superintendent.*—Upon the date named in the notice provided for herein for the taking of testimony, the division superintendent shall begin the taking of such testimony and shall continue until completed. In case the division superintendent of any water division is directly or indirectly interested in the water of any stream of his division, or is prevented by illness or otherwise from the taking of such proofs, the taking of testimony so far as relates to said stream shall be under the direction of any other member of the Board of Control. (L. O. L. § 6640.)

Section 17. *Fees.*—At the time of the submission of proof of appropriation, or at the time of the taking of testimony for the determination of rights to water, the division superintendent shall collect from each of the claimants or owners a fee of one dollar for the purpose of recording the water right certificate, when issued, in the office of the county clerk, together with the additional fee of fifteen cents for each acre of irrigated lands up to and including 100 acres, and five cents per acre for each acre in excess of 100 acres up to and including 1000 acres, and one cent for each acre in excess of 1000; also 25 cents for each theoretical horsepower up to and including 100 horsepower, and fifteen cents for each horsepower in excess of 100 up to and including 1000 horsepower, and five cents for each horsepower in excess of 1000 horsepower up to and including 2000 horsepower, and two cents for each horsepower in excess of 2000 horsepower, as set forth in such proof, the minimum fee, however, for any claimant or owner in such cases to be $2.50, also a fee of $5.00 for any other character of claim to water. All fees collected by the division superintendent shall be accounted for at the following regular meeting of the Board of Control and paid by such Board into the general fund of the State Treasury, except, however, those fees due or to be paid to the county clerk. But in cases of appropriations of water made under a permit issued under the provisions of this act, only $1.00 recording fee above provided shall be so collected by the division superintendent. (L. O. L. § 6641.)

Section 18. *Notice Upon Completion of Testimony.*—Upon the completion of the taking of testimony by the division superintendent, it shall be his duty at once to give notice by registered mail to the various

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claimants that at a time and place named in the notice not less than ten days thereafter, all of said evidence shall be open to inspection at said places not less than ten days, and such other time as fixed in the notice. Said superintendent shall also state in said notice the county in which the determination of the Board of Control will be heard by the circuit court; *provided*, that said cause shall be heard in the county in which said stream or some part thereof is situate. (L. O. L. § 6642.)

Section 19. *Contests.*—Should any person, corporation or persons owning any irrigation works, or claiming any interest in the stream or streams involved in the determination desire to contest any of the rights of the persons, corporations or associations who have submitted their evidence to the superintendent as aforesaid, such persons, corporations or associations, shall within five days after the expiration of the period as fixed in the notice for public inspection, notify the superintendent in writing, stating with reasonable certainty the grounds for their proposed contest, which statement shall be verified by the affidavit of the contestant, his agent or attorney, and the said division superintendent shall notify the said contestant and the person, corporation or association, whose rights are contested, to appear before him at such convenient place as the superintendent shall designate in said notice. (L. O. L. § 6643.)

Section 20. *Hearing.*—Said superintendent shall also fix the time and place for the hearing of said contest, which date shall not be less than 30 nor more than 60 days from the date the notice is served on the party, association or corporation, which notice and returns thereof shall be made in the same manner as summons are served in civil actions in the circuit courts of this State. Superintendents of water divisions shall have power to adjourn hearings from time to time upon reasonable notice to all the parties interested, and to issue subpœnas and compel the attendance of witnesses to testify upon such hearings, which shall be served in the same manner as subpœnas issued out of the circuit courts of the State, and shall have the power to compel such witnesses so subpœnaed to testify and give evidence in said matter, and said witnesses shall receive fees as in civil cases, the costs to be taxed in the same manner as are costs in suits in equity. The evidence in such proceedings shall be confined to the subjects enumerated in the notice of contest. (L. O. L. § 6644.)

Section 21. *Contests; Deposit Required.*—The superintendent shall require a deposit of $5.00 from each party for each day he shall be so engaged in taking evidence of said contest. Upon the final determination of the matters by the Board of Control, an order shall be entered directing that the money so deposited shall be refunded to the persons, associations or corporations in whose favor such contest shall be determined, and that all moneys deposited by other parties therein shall be turned over by the superintendent to the Board of Control who shall pay the same into the general fund of the State Treasury upon adjournment of each regular meeting of the Board. (L. O. L. § 6645.)

Section 22. *Evidence Transmitted.*—Upon the expiration of the period for which the evidence is kept open for inspection, the evidence in the original hearing before the superintendent, and the evidence taken in all contests, shall be transmitted by the superintendent to the office of the Board of Control in person, or by registered mail. Such evidence shall thereupon be filed with the Board. (L. O. L. § 6646.)

Section 23. *Measurements of Streams and Ditches.*—It shall be the duty of the State Engineer, or some qualified assistant, to proceed at the time specified in the notice to the parties on said stream to make

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an examination of said stream and the works diverting water therefrom, said examination to include the measurement of the discharge of said stream and of the carrying capacity of the various ditches and canals, and examination of the irrigated lands; and an approximate measurement of the lands irrigated or susceptible of irrigation from the various ditches and canals; and to take such other steps and gather such other data and information as may be essential to the proper understanding of the relative rights of the parties interested; which said observation and measurement shall be reduced to writing and made a matter of record in his office, and it shall be the duty of the State Engineer to make or cause to be made a map or plat on a scale of not less than one inch to the mile, showing with substantial accuracy the course of said stream, the location of each ditch or canal diverting water therefrom, and the legal subdivisions of lands which have been irrigated or which are susceptible of irrigation from the ditches and canals already constructed. (L. O. L. § 6647.)

Section 24. *Order Determining Water Rights.*—As soon as practicable after the compilation of said data, and the filing of said evidence, it shall be the duty of the Board of Control to make, and cause to be entered of record in its office, an order determining and establishing the several rights to the waters of said stream. As soon as practicable thereafter a certified copy of said determination shall be filed in the office of the county clerk of each county in which said stream, or any part thereof or any tributary, is situated, and the original evidence filed with the Board of Control shall be certified by the clerk of the Board and, together with a certified copy of said determination, shall be filed with the clerk of the circuit court by which such determination is to be heard. The determination of the Board shall be in full force and effect from the date of its entry in the records of the Board, unless and until its operation shall be stayed by a stay bond as provided for by this act. Upon the filing of the evidence with the circuit court of the county in which the determination is to be had, the Board shall procure an order from said court, or any judge thereof, fixing the time at which the determination shall be heard in said court. Copies of this order, certified by the clerk of said court, shall be filed by the Board as soon as practicable in the office of the county clerk of each county in which said determination is filed. (L. O. L. § 6648.)

Section 25. *Water Right Certificate.*—Upon the final determination of the rights to the waters of any stream, it shall be the duty of the secretary of the Board of Control to issue to each person, association or corporation represented in such determination a certificate to be signed by the president of the Board of Control, and attested under seal by the secretary of said Board, setting forth the name and postoffice address of the owner of the right; the priority of the date, extent and purpose of such right; and if such water be for irrigation purposes, a description of the legal subdivisions of land to which said water is appurtenant. Such certificate shall be transmitted by the president, or other member of the Board of Control, in person or by registered mail, to the county clerk of the county in which such right is located, and it shall be the duty of the county clerk upon receipt of the recording fee of one dollar collected as hereinbefore provided, to record the same in a book especially prepared and kept for that purpose, and thereupon immediately transmit the certificates to the respective owners. (L. O. L. § 6649.)

Section 26. *Court Procedure.*—From and after the filing of the evidence and order of determination in the circuit court, the proceedings shall be as nearly as may be like those in a suit in equity, except that any proceedings, including the entry of a decree, may be had in vaca-

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tion with the same force and effect as in term time. Within 30 days from the filing of such evidence and order in the circuit court, or within such further time as the court may for good cause allow, any party may file exceptions to the determination. If no exceptions shall be filed, the court shall on the day set for hearing enter a decree affirming the determination of the Board.

All parties may be heard by counsel upon the consideration of the exceptions. The court may, if necessary, remand the case for such further evidence to be taken by the superintendent of the water division as it may direct, and may require a further determination by the Board. After the hearing, the court shall enter a decree affirming or modifying the order of the Board of Control. Upon the hearing, the court may assess and adjudge against any party such costs as it may deem just. Appeals may be taken to the Supreme Court from such decrees in the same manner and with the same effect as in other cases in equity, except that notice of appeal must be served and filed within 60 days from the entry of the decree. (L. O. L. § 6650.)

Section 27. *Clerk Shall Transmit Transcript to Clerk of Board.*—The clerk of the circuit court, immediately upon the entry of any decree by the circuit court or by the judge thereof, shall transmit a certified copy of said decree to the secretary of the Board of Control. The secretary shall immediately enter the same upon the records of such office and the State Engineer shall forthwith issue to the superintendent or superintendents of water divisions instructions in compliance with the said decree, and in execution thereof. (L. O. L. § 6651.)

Section 28. *Distribution.*—During the time the hearing of the order of the Board of Control is pending in the circuit court, and until a certified copy of the judgment, order or decree of the circuit court is transmitted to the Board of Control, the division of water from the stream involved in such appeal shall be made in accordance with the order of the Board. (L. O. L. § 6652.)

Section 29. *Stay Bond.*—At any time after the determination of the Board has been entered of record, the operation thereof may be stayed in whole or in part by any party by filing a bond in the circuit court wherein such determination is pending in such amount as the judge thereof may prescribe, conditioned that such party will pay all damages that may accrue by reason of such determination not being enforced. Immediately upon the filing and approval of such bond, the clerk of the circuit court shall transmit to the Board of Control a certified copy of such bond, which shall be recorded in the records by such Board, and the State Engineer shall immediately give notice thereof to the superintendent of the proper water division. (L. O. L. § 6653.)

Section 30. *Rehearing.*—Within six months from the date of the decree of the circuit court determining the rights upon any stream, or if appealed within six months from the decision of the Supreme Court, the Board of Control, or any party interested, may apply to the circuit court for a rehearing upon grounds to be stated in the application. Thereupon, if in the discretion of the court it shall appear that there are good grounds for the rehearing, the circuit court, or judge thereof, shall make an order fixing a time and place when such application shall be heard. The clerk of the circuit court shall, at the expense of the petitioner, forthwith mail written notice of said application to the Board of Control and to every party interested, and state in such notice the time and place when such application will be heard. (L. O. L. § 6654.)

Section 31. *Authorized to Administer Oaths.*—The members of the

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Board of Control may administer oaths in the performance of their official duties. (L. O. L. § 6605.)

Section 32. *Fees.*—The secretary of the Board of Control shall collect the following fees, which shall be paid in advance, and accounted for to the Board, which fees shall be paid into the general fund of the State Treasury by such Board at the adjournment of each regular meeting; for making transcripts of the records of the Board of Control or of papers or documents filed with said Board, one dollar for the first folio and ten cents for each additional folio. For attaching certificate and seal of the Board to each transcript, one dollar. (L. O. L. § 6606.)

Section 33. *Conclusive, When.*—The determinations of the Board of Control as confirmed or modified as provided by this act in proceedings shall be conclusive as to all prior rights, and the rights of all existing claimants upon the stream or other body of water lawfully embraced in the determination. (L. O. L. § 6655.)

Section 34. *Duty of Water Right Claimants.*—Whenever proceedings shall be instituted for the determination of the rights to the use of any water, it shall be the duty of all claimants interested therein to appear and submit proof of their respective claims, at the time and in the manner required by law; and any such claimant who shall fail to appear in such proceedings and submit proof of his claims shall be barred and estopped from subsequently asserting any rights theretofore acquired upon the stream or other body of water embraced in such proceedings, and shall be held to have forfeited all rights to the use of said water theretofore claimed by him. Any person, association or corporation interested in the water of any stream upon whom or which no service of notice shall have been had of the pendency of proceedings for the determination of the rights to the use of the water of said stream, and who or which shall have no actual knowledge or notice of the pendency of said proceedings, may at any time prior to the expiration of one year after the entry of the determination of the Board, file a petition to intervene in said proceedings. Such petition shall contain, among other things, all matters required by this act, of claimants who have been duly served with notice of said proceedings and also a statement that the intervenor had no actual knowledge or notice of the pendency of said proceeding. Upon the filing of said petition in intervention, the petitioner shall be allowed to intervene upon such terms as may be equitable, and thereafter shall have all rights vouchsafed by this act to claimants who have been duly served. (L. O. L. § 6656.)

Section 35. *Proof Open to Inspection; Who May Contest.*—Whenever the rights to the waters of any stream have been determined as herein provided, and it shall appear by the records of such determination that it had not been at one and the same proceeding, then in such case the Board of Control may open to public inspection, all proofs or evidence of rights to the water, and the findings of the Board in relation thereto in the manner provided in section 18; and any persons, corporations, or associations who may desire to contest the claims or rights of other persons, corporations, or associations, as set forth in the proofs or established by the Board, shall proceed in the manner provided for in sections 19, 20 and 22; *provided*, that contests may not be entered into and shall not be maintained except between claimants who were not parties to the same adjudication proceedings in the original hearings. (L. O. L. § 6657.)

WATER MASTERS.

Section 36. *Districts.*—The Board of Control shall divide each water division into water districts, and said water districts to be so constituted

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as to secure the best protection to the claimants for water and the most economical supervision on the part of the State; said water district shall not be created until a necessity therefor shall arise, but shall be created from time to time as the claims thereof from the streams of the State shall be determined. (L. O. L. § 6615.)

Section 37. *Water Master; How Appointed.*—There shall be appointed by the Board of Control, one water master for each water district, who shall be a resident of the district he is appointed for and who shall have been a resident of said district for one year immediately prior to the date of his appointment, shall be selected from persons recommended by the superintendent of the water division in which such water district is situated. Each water master shall hold his office until his successor is elected and shall have qualified, and the Board of Control shall, by like selection and appointment, fill all vacancies which shall occur in the office of water master. (L. O. L. § 6616.)

Section 38. *Duty of Water Master.*—It shall be the duty of the said water masters to divide the water of the natural streams or other sources of supply of his district among the several ditches and reservoirs, taking water therefrom, according to the rights of each respectively, in whole or in part, and to shut and fasten, or cause to be shut and fastened, the headgates of ditches, and shall regulate or cause to be regulated, the controlling works of reservoirs, in time of scarcity of water, as may be necessary by reason of the rights existing from said streams of his district. The water master shall have authority to regulate the distribution of water among the various users under any partnership ditch or reservoir, where rights have been determined, in accordance with existing decrees. Whenever, in the pursuance of his duties, the water master regulates a headgate to a ditch or the controlling works of reservoirs, it shall be his duty to attach to such headgate or controlling works, a written notice properly dated and signed, setting forth the fact that such headgate or controlling works has been properly regulated and is wholly under his control, and such notice shall be a legal notice to all parties interested in the division and distribution of the water of such ditch or reservoir. It shall be the duty of the district attorney to appear for, or on behalf of the division superintendent or any water master in any case which may arise in the pursuance of the official duties of any such officer within the jurisdiction of said district attorney. (L. O. L. § 6617.)

Section 39. *Water Master Shall Prevent Waste.*—Said water master shall, as near as may be, divide, regulate and control the use of the water of all streams within his district by such closing or partially closing of the headgates as will prevent the waste of water, or its use in excess of the volume to which the owner of the right is lawfully entitled, and any person who may be injured by the action of any water master, shall have the right to appeal to the circuit court for an injunction. Such injunction shall only be issued in case it can be shown at the hearing that the water master has failed to carry into effect the order of the Board of Control or decrees of the court determining the existing rights to the use of water. (L. O. L. § 6618.)

Section 40. *Pay Of.*—Each water master herein provided for shall receive compensation at the rate of $5.00 per day for each day he shall be actively employed in the duties of his office. Where the service may be improved by continuous employment and upon recommendation of the division superintendent and the approval of the county court of the county, or counties, in which said district is located by an order, or orders, made at regular term, or terms, thereof when sitting for the transaction of county business, he shall receive pay at the rate of $100

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per month, in either case to be paid by the county in which the work is performed. Each water master shall keep a true and just account of time spent by him in the duties of each county, respectively, in which his duties may extend, and he shall present true copy thereof, verified by oath, to the county court sitting for the transaction of county business of the county in which his work may be performed. And the county court shall, upon approval thereof by the superintendent of the water division, allow and pay the same. *Provided*, any water master may be suspended by an order of the county court of any county in which his district may lie in case said court shall find and enter an order to the effect that said water master is claiming more time than the public service requires, and during such suspension such water master shall receive no pay. (L. O. L. § 6619.)

Section 41. *Employment of Assistants.*—Said water master shall have power, in cases of emergency, to employ suitable assistants to aid him in the discharge of his duties. Such assistants shall take the same oath as the water master, and shall obey his instructions, and each shall be entitled to such compensation as his services may demand and as the superintendent may recommend, not to exceed in any case, $4.00 per day for each day he is employed, such payment to be made upon certificates of the division superintendent in the same manner as provided for the payment of the water master. The term of service of such assistant water master may be terminated at any time by the division superintendent, and shall in no event continue after the emergency has ceased to exist. (L. O. L. § 6620.)

Section 42. *Water Masters to Begin Work, When.*—When arrangements are not made for employment of a water master at a monthly rate, as provided in section 40 of this act, the said water master shall begin his work upon written demand being made upon him therefor by one or more water users. Such written demand for his services shall be attached to his bill for services and forwarded with it to the county commissioners of the proper county. Where the said water master is employed by the month he shall begin work and terminate his services as the superintendent of his water division may direct. The division superintendent may, under any condition, call upon the water master for work within his district whenever the necessity therefor may in his judgment arise. (L. O. L. § 6621.)

Section 43. *Interference With Headgate; Penalty.*—Any person who shall willfully open, close, change or interfere with any lawfully established headgate or water box without authority, or who shall willfully use water or conduct water into or through his ditch which has been lawfully denied him by the water master or other competent authority, shall be deemed guilty of a misdemeanor. The possession or use of water when the same shall have been lawfully denied by the water master or other competent authority shall be *prima facie* evidence of the guilt of the person using it. (L. O. L. § 6622.)

Section 44. *Power of Arrest.*—The water master, or his assistants, within his district shall have power to arrest any person or persons violating any of the provisions of this act and turn them over to the sheriff or other competent police officer within the county; and immediately upon delivering any such person so arrested into the custody of the sheriff, it shall be the duty of the water master making such arrest to immediately, in writing and upon oath, make complaint before the proper justice of the peace against the person so arrested. (L. O. L. § 6623.)

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PROCEDURE RELATIVE TO THE APPROPRIATION OF WATER.

Section 45. *Application.*—Any person, association or corporation hereafter intending to acquire the right to the beneficial use of any waters shall, before commencing the construction, enlargement or extension of any ditch, canal or other distributing or controlling works, or performing any work in connection with said construction, or proposed appropriation, make an application to the State Engineer for a permit to make such appropriation. Any person who shall willfully divert or use water to the detriment of others without compliance with law, shall be deemed guilty of a misdemeanor. The possession or use of water, except when a right of use is acquired in accordance with law, shall be *prima facie* evidence of the guilt of the person using it. (L. O. L. § 6624.)

Section 46. *Applications, Nature Of.*—Each application for permit to appropriate water shall set forth the name and postoffice address of the applicant, the source of water supply, the nature and amount of the proposed use, the location and description of the proposed ditch, canal, or other work, the time within which it is proposed to begin construction, the time required for completion of the construction, and the time for the complete application of the water to the proposed use. If for agricultural purposes, it shall give the legal subdivisions of the land and the acreage to be irrigated, as near as may be. If for power purposes, it shall give the nature of the works by means of which the power is to be developed, the head and amount of water to be utilized, and the uses to which the power is to be applied. If for the construction of a reservoir, it shall give the height of dam, the capacity of the reservoir, and the uses to be made of the impounded waters. If for municipal water supply, it shall give the present population to be served, and, as near as may be, the future requirements of the city. If for mining purposes, it shall give the nature of the mines to be served, the methods of supplying and utilizing the water. All applications shall be accompanied by such maps and drawings, in duplicate, and such other data as may hereafter be prescribed by the Board of Control, and such accompanying data shall be considered as a part of the application. (L. O. L. § 6626.)

Section 47. *Applications, Approval Of.*—Upon receipt of an application, it shall be the duty of the State Engineer to make an indorsement thereon of the date of its receipt and to keep a record of the same. If upon examination the application is found to be defective, it shall be returned for correction or completion, and the date of, and reasons for the return thereof, shall be indorsed thereon and made a record in his office. No application shall lose its priority of filing on account of such defects, provided acceptable maps and drawings are filed in the office of the State Engineer within 30 days from the date of said return to the applicant. All applications which shall comply with the provisions of this act shall be recorded in a suitable book kept for that purpose, and it shall be the duty of the State Engineer to approve all applications made in proper form which contemplate the application of water to a beneficial use, but when the proposed use conflicts with determined rights, or is a menace to the safety and welfare of the public, the application shall be referred to the Board of Control for consideration. It shall be the duty of the Board to enter an order directing the refusal of such application, if, after full hearing, the public interest demands. An application may be approved for a less amount of water than that applied for, if there exists substantial reasons therefor, and in any event shall not be approved for more

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water than can be applied to a beneficial use. Applications for municipal water supplies may be approved to the exclusion of all subsequent appropriations, if the exigencies of the case demand upon consideration and order by the Board of Control. (L. O. L. § 6627.)

Section 48. *Application, How Indorsed.*—The approval or rejection of an application shall be indorsed thereon and a record made of such indorsement in the State Engineer's office. The application so indorsed shall be returned immediately to the applicant by mail. If approved, the applicant shall be authorized, on receipt thereof, to proceed with the construction of the necessary works, and to take all steps required to apply the water to a beneficial use, and to perfect the proposed appropriation. If the application is refused, the applicant shall take no steps toward the construction of the proposed work or the diversion and use of water so long as such refusal shall continue in force. (L. O. L. § 6628.)

Section 49. *Assignment of Permit.*—Any permit or license to appropriate water may be assigned, subject to the conditions of the permit, but no such assignment shall be binding, except upon the parties thereto, unless filed for record in the office of the State Engineer. (L. O. L. § 6629.)

Section 50. *Limitation on Time of Completing Work.*—Actual construction work shall begin one year from the date of approval of the application and the construction of any proposed irrigation or other work shall thereafter be prosecuted with reasonable diligence, and be completed within a reasonable time, as fixed in the permit, not to exceed five years from the date of such approval. The Board of Control shall, for good cause shown, extend the time within which irrigation or other works shall be completed, or the right perfected, under any permit which may be submitted for its consideration by the State Engineer. (L. O. L. § 6630.)

Section 51. *Appeals.*—Any applicant may appeal to the Board of Control for relief, which Board may modify the decisions of the State Engineer if it shall appear that he has abused the authority reposed in him by law. Such appeal shall be taken within 30 days from the date of such decision by the State Engineer, and shall be perfected when the applicant shall have filed in the office of the Board a copy of the order appealed from, together with a petition setting forth the appellant's reason for appeal, and such appeal shall be heard and determined upon such competent proof as shall be adduced by the applicant, and such like proofs as shall be adduced by the State Engineer. The State Engineer shall not sit as a member of the Board on such appeal. (L. O. L. § 6631.)

Section 52. *Fees.*—The following fees shall be collected by the State Engineer in advance, and be paid by him into the general fund of the State Treasury on the last day of March, June, September and December of each year:

(*a*) For examining an applicant for permit to appropriate water, three dollars.

(*b*) For filing and recording permit to appropriate water for irrigation purposes, fifteen cents per acre for each acre to be irrigated up to and including 100 acres, and five cents per acre for each acre in excess of 100 and up to and including 1,000 acres; and one cent per acre for each acre in excess of 1,000 acres, or in case the application is for power purposes, 25 cents for each theoretical horsepower to be developed up to and including 100, and ten cents for each horsepower in excess of 100 and up to and including 1,000, and five cents for each horsepower in excess of 1,000; or, in case the application is for

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any other purpose, including applications by municipalities for power purposes, $5.00 for filing and recording each permit.

(*c*) For filing or recording any other water right instrument, $1.00 for the first 100 words and ten cents for each additional 100 words or fraction thereof.

(*d*) For making copy of any document recorded or filed in his office, ten cents for each 100 words or fraction thereof; but where the amount exceeds $5.00, then only the actual cost in excess of that amount shall be charged.

(*e*) For certifying to copies, documents, records, or maps, $1.00 for each certificate.

(*f*) For blue print copy of any map or drawing, ten cents per square foot or fraction thereof. For such other work as may be required of his office, actual cost of the work. (L. O. L. § 6601.)

Section 53. *Water Right Certificate.*—Upon it being made to appear to the satisfaction of the Board of Control that any appropriation has been perfected in accordance with the provisions of this act, it shall be the duty of the Board of Control to issue to the applicant a certificate of the same character as that described in section 25. Said certificate shall be recorded and transmitted to the applicant as provided in said section. Certificates issued for rights to the use of water for power development acquired under the provisions of this act shall limit the right or franchise to a period of 40 years from date of application, subject to a preference right of renewal under the laws existing at the date of expiration of such franchise or right. (L. O. L. § 6633.)

Section 54. *Date of Right.*—The right acquired by such appropriation shall date from the filing of the application in the office of the State Engineer. (L. O. L. § 6634.)

Section 55. *Headgate, Maintenance Of.*—The owner or owners of any ditch or canal shall maintain, to the satisfaction of the division superintendent of the division in which the irrigation works are located, a substantial headgate at the point where the water is diverted, which shall be of such construction that it can be locked and kept closed by the water master; and such owners shall construct and maintain when required by the division superintendent, suitable measuring devices at such points along such ditch as may be necessary for the purpose of assisting the water master in determining the amount of water that is to be diverted into said ditch from the stream, or taken from it by the various users. Any and every owner or manager of a reservoir, located across or upon the bed of a natural stream, shall be required to construct and maintain, when required by the division superintendent, a measuring device of a plan to be approved by the State Engineer, below such reservoir, and a measuring device above such reservoir on each or every stream or source of supply discharging into such reservoir, for the purpose of assisting the water master or superintendent in determining the amount of water to which appropriators are entitled and thereafter diverting it for such appropriators' use. When it may be necessary for the protection of other water users, the division superintendent may require flumes to be installed along the line of any ditch. If any such owner or owners of irrigation works shall refuse or neglect to construct and put in such headgates, flumes or measuring devices after ten days' notice, the division superintendent may close such ditch, and the same shall not be opened or any water diverted from the source of supply, under the penalties prescribed by law for the opening of headgates lawfully closed, until the requirements of the division superintendent as to such headgate, flumes or measuring device have been complied with, and if any owner or manager of a reservoir located

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across the bed of a natural stream shall neglect or refuse to put in such measuring device after ten days' notice by the division superintendent, such superintendent may open the sluice gate or outlet of such reservoir and the same shall not be closed under penalties of the law for changing or interfering with headgates, until the requirements of the division superintendent as to such measuring devices are complied with. (L. O. L. § 6660.)

Section 56. *Engineer's Authority to Inspect.*—The State Engineer shall have authority to examine and inspect, during construction, any dam, authorized under the provisions of this chapter, or any ditch, canal or other work, and at the time of such inspection, or thereafter, he shall notify the parties constructing such dam, or other works, of any addition or alteration which he considers necessary for the security of the work or the safety of any person or persons residing on or owning land in the vicinity of such works, or for the safety of their property. (L. O. L. § 6661.)

Section 57. *Inspection; When Required.*—Should any person or persons residing on or owning land in the neighborhood of any irrigation works after completion, or in course of construction, apply to the State Engineer in writing desiring an inspection of such works, the State Engineer may order an inspection thereof. Before doing so he may require the applicant for such inspection to make a deposit of a sum of money sufficient to pay the expenses of an inspection, and in case the application appears to him not to have been justified, he may cause the whole or part of such expenses to be paid out of such deposit. In case the application appears to the State Engineer to have been justified, he may require the owner of the works to pay the whole or any part of the expenses of the inspection, and the same shall constitute a valid lien against the works, which may be enforced in the same manner as provided for the enforcement of mechanics' liens. (L. O. L. § 6662.)

RESERVOIRS.

Section 58. *Procedure Under Reservoir Permit.*—All applications for reservoir permits shall be subject to the provisions of sections 45 to 51, both inclusive, except that an enumeration of any lands proposed to be irrigated under this act shall not be required in the primary permit. But the party or parties proposing to apply to a beneficial use the water stored in any such reservoir shall file an application for permit, to be known herein as the secondary permit, in compliance with the provisions of sections 45 to 51, both inclusive. Said application shall refer to such reservoir for a supply of water and shall show by documentary evidence that an agreement has been entered into with the owners of the reservoir for a permanent and sufficient interest in said reservoir to impound enough water for the purpose set forth in said application. When beneficial use has been completed and perfected under the secondary permit, the division superintendent shall take the proof of the water user under such permit and the final certificate of appropriation shall refer to both the ditch described in the secondary permit and the reservoir described in the primary permit. (L. O. L. § 6632.)

Section 59. *Duty of Water Master and Costs; How Payable.*—Whenever the owner, manager or lessee of a reservoir, constructed under the provisions of this act, shall desire to use the bed of a stream, or other water course, for the purpose of carrying stored or impounded water from the reservoir to the consumer thereof, he shall, in writing, notify the water master of the district in which the stored or impounded

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water is to be used, giving the date when it is proposed to discharge water from such reservoir, its volume, and the names of all persons and ditches entitled to its use. It shall then be the duty of such water master to close, or so adjust the headgates of all ditches from the stream or water course, not entitled to the use of such stored water, as will enable those having the right to secure the volume to which they are entitled. The water master shall keep a true and just account of the time spent by him in the discharge of his duties as defined in this section, and it shall be the duty of the county commissioners of the county wherein the expense is incurred, to present a bill of one-half the expense so incurred to the reservoir owner, manager or lessee, and if such owner, manager or lessee shall neglect for 30 days, after the presentation of such bill of costs, to pay the same, the said costs shall be made a charge upon said reservoir and shall be collected as delinquent taxes until the complete payment of such bill of costs has been made. (L. O. L. § 6663.)

Section 60. *Attorney General and District Attorneys Advisors of State Engineer.*—The Attorney General and the district or prosecuting attorney of the county in which legal questions arise, shall be the legal advisors of the State Engineer and of the Board of Control, and shall perform any and all legal duties necessary in connection with their work, without other compensation than their salaries as fixed by law. (L. O. L. § 6608.)

Section 61. *Joint Owners; Responsibility.*—In all cases where ditches are owned by two or more persons and one or more of such persons shall fail or neglect to do a proportionate share of the work necessary for the proper maintenance and operation of such ditch or ditches or to construct suitable headgates or measuring devices at the points where water is diverted from the main ditch, such owner or owners desiring the performance of such work may, after having given ten days' written notice to such other owner or owners who have failed to perform such proportionate share of the work, necessary for the operation and maintenance of said ditch or ditches, perform such share of the work, and recover therefor from such person or persons in default the reasonable expense of such work. (L. O. L. § 6664.)

Section 62. *Lien for Work Performed on Ditch.*—Upon the failure of any co-owner to pay his proportionate share of such expense, as mentioned in the preceding section, within 30 days after receiving a statement of the same as performed by his co-owner or owners, such person or persons so performing such labor may secure payment of said claim by filing an itemized and sworn statement thereof, setting forth the date of the performance and the nature of the labor so performed, with the county clerk of the county wherein said ditch is situated, and when so filed it shall constitute a valid lien against the interest of such person or persons in default, which said lien may be established and enforced in the same manner as provided by law for the enforcement of mechanics' liens. (L. O. L. § 6665.)

Section 63. *Regulation of Partnership Ditches and Reservoirs.*—When two or more persons, joint owners in an irrigation ditch or reservoir, not incorporated, or their lessees, are unable to agree relative to the division or distribution of water received through their ditch or from their reservoir, it shall be lawful for any such owner or owners, his or their lessee or lessees, or either of them, to apply to the water master of the district in which such ditch or reservoir shall be located, by a written notice setting forth such fact, asking the water master to take charge of such ditch or reservoir for the purpose of making a just division or distribution of the water from the same,

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to the parties entitled to the use thereof. The said water master shall take exclusive charge of such ditch or reservoir for the purpose of dividing the water therefrom in accordance with established rights, and continuing the said work until the necessity therefor shall cease to exist. In all cases where the water master or an assistant water master is called upon to divide the waters of a ditch or reservoir between appropriators, he shall be paid in full for his services by the interested water users in proportion to the established rights of each, and shall have a lien upon any land irrigated by the water owned by an interested water user refusing to pay, said lien to be established and enforced in the same manner as a mechanics' lien. (L. O. L. § 6666.)

Section 64. *Injunctions.*—In suits for injunction affecting the use of water from streams upon which the rights to water have been determined, no restraining order shall be granted before hearing had after at least three days' notice thereof, served upon all persons defendant. All suits for injunction involving the use of water shall be heard, either in term time or during vacation, not later than fifteen days after issues joined, unless for good cause shown further time be allowed. (L. O. L. § 6667.)

Section 65. *Water Appurtenant to Land for Irrigation Purposes.*—All water used in this State for irrigation purposes shall remain appurtenant to the land upon which it is used; *provided*, that if for any reason it should at any time become impracticable to beneficially or economically use water for the irrigation of any land to which the water is appurtenant said right may be severed from said land, and simultaneously transferred, and become appurtenant to other land, without losing priority of right theretofore established, if such change can be made without detriment to existing rights, on the approval of an application of the owner to the Board of Control. Before the approval of such transfer an inspection shall be made by the proper division superintendent, who shall submit his report to the Board of Control, whereupon, by order, the Board shall approve or disapprove such transfer and prescribe the conditions thereof. Such order shall be subject to appeal as in this act provided. (L. O. L. § 6668.)

Section 66. *Unlawful Use of Water and Waste.*—The unauthorized use of water to which another person is entitled, or the willful waste of water to the detriment of another, shall be a misdemeanor, and the possession or use of such water without legal right, shall be *prima facie* evidence of the guilt of the person using it. It shall also be a misdemeanor to use, store or divert any water until after the issuance of permit to appropriate such waters. (L. O. L. § 6669.)

Section 67 *Obstructing Works.*—Whenever any appropriator of water has the lawful right of way for the storage, diversion, or carriage of water, it shall be unlawful to place or maintain any obstruction that shall interfere with the use of the works, or prevent convenient access thereto. Any violation of the provisions of this section shall be a misdemeanor. (L. O. L. § 6670.)

Section 68. *Penalty for Mis lemeanors Under This Act.*—All violations of the provisions of this act, declared herein to be misdemeanor, shall be punished by a fine not exceeding two hundred and fifty dollars nor less than ten dollars, or by imprisonment in the county jail not exceeding six months, or by both such fine and imprisonment. (L. O. L. § 6671.)

Section 69. *Appropriations.*—There is hereby appropriated out of any moneys in the general fund of the State Treasurer not otherwise appropriated the sum of $10,000 annually, or so much thereof as may be necessary for the payment of the salaries and expenses incurred by the Board of Control under the provisions of this act.

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There is hereby appropriated out of any moneys in the general fund of the State Treasury not otherwise appropriated the sum of $5,000 annually, or so much thereof as may be necessary for the salary and expenses of the State Engineer, and the services of assistants, and expenses of the office and department of the State Engineer, which appropriation is in addition to the $5,000 annual appropriation heretofore made in Chapter 228, Session Laws of 1905.

All salaries and expenses incurred, and material and supplies furished under the provisions of this act shall be paid at the same time and in the same manner as those of other officers of the State. (L. O. L. § 6607.)

Section 70. *Vested Rights Preserved.*—

1. Nothing in this act contained shall impair the vested rights of any person, association or corporation to the use of water.

2. Actual application of water to beneficial use prior to the passage of this act by or under authority of any riparian proprietor, or by or under authority of his or its predecessors in interest, shall be deemed to create in such riparian proprietor a vested right to the extent of the actual application to beneficial use; *provided,* such use has not been abandoned for a continuous period of two years.

3. And where any riparian proprietor, or under authority of any riparian proprietor or his or its predecessors in interest, any person or corporation shall, at the time this act is filed with the Secretary of State, be engaged in good faith in the construction of works for the application of water to a beneficial use, the right to take and use such water shall be deemed vested in such riparian proprietor; *provided,* such works shall be completed and said water devoted to a beneficial use within a reasonable time after the passage of this act. The Board of Control, in the manner hereinafter provided, shall have power and authority to determine the time within which such water shall be devoted to a beneficial use. The right to water shall be limited to the quantity actually applied to a beneficial use within the time so fixed by the Board of Control.

4. Nor shall anything in this act contained affect relative priorities to the use of water between or among parties to any decree of the courts rendered in causes determined or pending prior to the taking effect of this act.

5. Nor shall the right of any person, association or corporation, to take and use water be impaired or affected by any of the provisions of this act where appropriations have been initiated prior to the filing of this act in the office of the Secretary of State, and such appropriators, their heirs, successors or assigns, shall, in good faith and in compliance with laws existing at the time of filing this act in the office of the Secretary of State, commence the construction of works for the application of the water so appropriated to a beneficial use, and thereafter prosecute such work diligently and continuously to completion, but all such rights shall be adjudicated in the manner provided in this act.

6. The Board of Control shall have authority, and shall for good cause, shown upon the application of any appropriator, or user of water under an appropriation of water made prior to the passage of this act, or in the cases mentioned in subdivisions 3 and 5 of this section, where actual construction work has been commenced prior to said time or within the time provided in law existing at the time of filing this act in the office of the Secretary of State, to prescribe the time applied to a beneficial use, and in determining said time shall grant a reasonable time after the construction of the works, or canal, or ditch, used for the diversion of the water, and in doing so shall take

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into consideration the cost of the appropriation and application of such water to a beneficial purpose, the good faith of the appropriator, the market for water power to be supplied, the present demands therefor, and the income or use that may be required to provide fair and reasonable returns upon the investment. Upon making such order the Board of Control shall direct the State Engineer to issue a certificate showing such determination. For good cause shown the Board of Control may extend the time by granting further certificates.

7. And where appropriations of water heretofore attempted have been undertaken in good faith, and the work of construction or improvement thereunder has been in good faith commenced and diligently prosecuted, such appropriations shall not be set aside or avoided, in proceedings under this act, because of any irregularity or insufficiency of the notice by law, or in the manner of posting, recording or publication thereof.

8. All rights granted or declared by this act shall be adjudicated and determined in the manner and by the tribunals as provided in this act. This act shall not be held to bestow upon any person, association or corporation, any riparian rights where no such rights existed prior to the time this act takes effect. (L. O. L. § 6595.)

Section 71. *Portland Water Supply.*—The exclusive right to the use of the waters of Bull Run and Little Sandy rivers is hereby granted to the city of Portland, and all rights to the waters of the lakes, rivers and streams of this State heretofore acquired for the purposes of municipal water supply are hereby confirmed and no rights which shall be acquired under this act shall impair the rights of any municipal corporation to waters theretofore taken. The Board of Control shall reject, or grant, subject to municipal use, all applications where, in its judgment, the appropriation of the waters applied for impair a municipal water supply. It shall be the duty of municipal corporations of the State, on request of the State Engineer, to furnish to him a statement of the amount and source of the municipal water supply, with probable increase or extension of the same; *provided*, that this act shall not be deemed or held to and shall not impair the rights of any person, association or corporation who may, at and prior to the time of this act is filed in the office of the Secretary of State, have any vested right to or valid appropriation or *bona fide* notice of appropriation of the waters of either the Bull Run or the Little Sandy rivers under laws heretofore in effect or under any valid contract or deed of conveyance heretofore made with or by the city of Portland. (L. O. L. § 6672.)

Section 72. *Eminent Domain.*—The United States, the State, or any person, foreign or domestic corporation or association, may exercise the right of eminent domain to acquire for a public use any property or rights now or hereafter existing when found necessary for the application of water to beneficial uses, including the right to enlarge existing structures and use the same in common with the former owner. Any right of way so acquired shall be so located as to do the least damage to private or public property, consistent with proper and economical engineering construction. Such property or rights may be acquired in the manner provided by law for the taking of private property for public use.

The right to conduct water from or over the land of another for any public use, including the right to raise any water by means of dams, reservoirs or embankments to a sufficient height to make the same available for the use intended, and the right to any and all land necessary therefor, may be acquired upon payment of just com-

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pensation in the manner provided by law for the taking of private property for public use. (L. O. L. § 6596.)

Section 73. *Repeal.*—All laws and parts of laws so far as in conflict or inconsistent with the provisions of this act are hereby repealed.

Section 74. *Emergency.*—WHEREAS, there is great uncertainty existing throughout the State with reference to the water rights of various parties along the streams, ditches and waterways as to their several interests therein, entailing expensive litigation and engendering many animosities and much bad blood, thereby endangering the public peace and safety of many sections of the State, and WHEREAS, it is urgent that these conditions be remedied for the preservation of the public peace, health and safety of the State, this act shall be in full force and effect from and after its approval by the Governor.

Filed in the office of the Secretary of State February 24, 1909.

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